IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Examiner: Daniel Lawson Greene

Group Art Unit: 3694

In re Application of:
Kirkland D. Broach et al.

Serial No. 10/751,349

Filed: January 5, 2004

NUCLEAR FUEL ASSEMBLY DEBRIS FILTER BOTTOM NOZZLE

Attorney Docket No. ARF-2004-003

APPELLANTS' BRIEF ON APPEAL

November 28, 2006

Commissioner for Patents
MAIL STOP APPEAL BRIEF - PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal from the decision of the Examiner, dated July 18, 2006, rejecting Claims 1, 2 and 4-17 of the above-identified application. The claims are set forth in the Claims Appendix, which is attached hereto. Due to the specific nature of the issues involved in this Appeal, an Oral Hearing is not deemed necessary and is not requested. Payment of the filing fee for Appellants' Brief in the amount of $500.00 will be charged to Eckert Seamans Cherin & Mellott, LLC's American Express Card during the electronic submission process. Please charge any deficiency in payment or credit any overpayment to Deposit Account No. 02-2556.

Real Party In Interest

The real party in interest is Westinghouse Electric Company LLC, seventy-seven percent owned by Toshiba Corporation, twenty percent owned by the Shaw Group, Inc. and three percent owned by Ishikawajima Harima Industries Company, LTD. An assignment from the inventors to Westinghouse Electric Company LLC was recorded on January 5, 2004, and is recorded at Reel/Frame 014875/0020.

Related Appeals and Interferences

There are no appeals or interferences known to Appellant or to Appellant's legal representative which will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

Status of the Claims

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirements.

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement.

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claims 1, 2 and 7-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger (4,900,507) in view of any of U.S. Patents 4,997,621 to Johansson et al. ('621), U.S. Patent 5,528,640 to Johansson et al. ('640), U.S Patent 5,473,650 to Johansson ('650) or U.S. Patent 5,488,634 to Johansson et al. ('634).

Claims 4, 6 and 13-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger as modified by any of U.S. Patents 4,997,621 to Johansson et al., U.S. Patent 5.528,640 to Johansson et al., U.S Patent 5.473.650 to Johansson or U.S. Patent 5,488,634 to Johansson et al. Further, in view of the teachings of the Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958.

Claims 1, 2, 4 and 6-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger in view of either the Mechanical Engineering Handbook, CRC Press LLC, copyright 1999 or the Industrial Burners' Handbook, CRC Press LLC, copyright 2003 or the Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958 and further in view of either Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958, or Tucker (4,118,973).

Claim 5 is rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger and further in view of the teachings of Chapter 42, Fluid Measurements, of The Engineering Handbook, CRC Press LLC, copyright 2000.

Status of the Amendments

There are currently no outstanding amendments to the pending claims. The claims as they stand on Appeal are contained in the Claims Appendix to this Brief.

Summary of the Claimed Subject Matter

The present invention provides a debris filter bottom nozzle 12 (page 6, line 2) for a pressurized water nuclear reactor fuel assembly 10. The debris filter bottom nozzle 12 comprises a substantially horizontal plate 46 (page 6, line 5) extending substantially traverse to the axis of fuel rods 22 (page 5, line 3), an upper face directed toward a lowermost spacer grid 20 (page 5, line 4). The upper face of the plate 46 has defined therethrough at least two different hole designs 52 and 54 (page 8, line 6). The holes 52 (page 7, line 23) are designed to receive lower ends of guide thimbles 18, which are supported by the plate 46. The second hole design 54 (page 8, line 6) is formed as flow though holes extending completely through the plate 46 for the passage of coolant fluid from a lower face of the plate 46 to the upper face of the plate 46 with each of the coolant flow through holes extending substantially in the axial direction of the fuel rods 22 and in fluid communication with unoccupied spaces in the spacer grids 20. In independent Claims 1 and 12, the flow through holes 54 are said to have a profile substantially of a venturi (page 8, line 9) with flaring at both ends. In independent Claim 1. the flaring at the lower face of the plate 46 comprises a series of a plurality of concentric countersinks 56 (page 8, line 27) of different included angles and depths (page 9, line 7) into the coolant flow through hole. In independent claim 12, the flaring at the lower face of the plate 46 comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer 56 (page 9, line 1) relative to the axial direction of the fuel rods 22. Independent Claim 13 defines the contour of the flow through holes 54 having a discrete. double chamfered inlet 56 (page 9, line 1) with each adjacent chamfer of the double chamfered inlet at a different angle than the other adjacent chamfer relative to the axial direction of the fuel rods 22. The corresponding portion of the specification can be found starting at page 8, line 24 through page 10, line 10.

The claims addressed on this appeal include:

1. A fuel assembly 10 (page 4, line 17) for a pressurized water nuclear reactor including a plurality of elongated nuclear fuel rods 22 (page 4, line 31) having an extended axial length, at least a lowermost grid 20 (page 5, line 27) supporting said fuel rods in an organized array and having unoccupied spaces (page 6, line 22) defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods 22 when said fuel assembly 10 is installed in the nuclear reactor and a plurality of guide thimbles 18 (page 4, line 26) extending along said fuel rods through and supporting said grid, a debris filter bottom nozzle 12 (page 5. line 25) disposed below said grid, below lower ends of said fuel rods. supporting said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate 46 (page 6, line 5) extending substantially transverse to the axis of the fuel rods and having an upper face directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different hole designs, the first hole design 52 (page 7, line 23) being a plurality of holes receiving lower ends of said guide thimbles where they are supported by said plate and the second hole design 54 (page 8, line 6) being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and in the extended direction at least some of said coolant flow through holes having a profile substantially of a venturi with flaring at both ends, wherein the flaring at the lower face of said plate 56 (page 8, line 27) comprises a series of a plurality of concentric countersinks of different included angles and depths (page 9, line 7) into the coolant flow through hole.

2. The nuclear fuel assembly 10 of Claim 1 wherein said coolant flow through holes 54 (page 8, line 10) having a profile substantially of a venturi have an inlet end 56 (page 8, line 28) in the lower face of said plate 46 and an outlet end 59 (page 8, line 29) in the upper face of said plate wherein the venturi is substantially formed by the concentric countersinks of different included angles and depths (page 9, line 7) into the coolant flow through hole in said inlet and a chamfer in said outlet end.

3. (canceled)

4. The nuclear fuel assembly 10 of Claim 1 wherein the inlet chamfers 56 (page 8, line 28) approximates a curved surface.

5. The nuclear fuel assembly 10 of Claim 4 wherein the chamfers 56 (page 8, line 28) have the following dimensions and angles relative to a flow axis of the flow through hole 54 (page 8, line 6) where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes (page 9, line 7).

	Angle	Nominal Length (in.)	Maximum Length (in.)	Minimum Length (in.)
Chamfer A	35° ± 3°	0.017 (0.043 cm)	0.039 (0.099 cm)	0.012 (0.030 cm)
Chamfer B	15° ± 3°	0.039 (0.099 cm)	0.057 (0.145 cm)	0.010 (0.025 cm)
Chamfer C	10° ± 3°	0.085 (0.361 cm)	0.142 (0.361 cm)	0.059 (1.397 cm)

6. The nuclear fuel assembly 10 of Claim 4 wherein the chamfers 56,58 (page 9, line 14) have the following relative dimensions and angles with regard to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes and L/T is the length of the chamfer divided by the thickness of the plate 46.

	Angle	Chamfer L/T	
		Maximum	Minimum
Chamfer A	2.33 x B	0.071	0.020
Chamfer B	15° +/- 3°	0.104	0.017
Chamfer C	0.67 x B	0.258	0.101

7. The nuclear fuel assembly 10 of Claim 1 wherein substantially every coolant flow through hole 48 (page 8, line 9) not associated with a guide thimble 18 has the venturi profile in the extended direction.

8. The nuclear fuel assembly 10 of Claim 1 including support means 40 (page 6, line 4) adapted to support said fuel assembly when installed in the nuclear reactor with said plate 46 (page 6, line 5) fixed at its periphery on said support means.

9. The nuclear fuel assembly 10 of Claim 1 wherein the coolant flow through holes 48 have a substantially circular cross-section (page 7, line 6).

10. The nuclear fuel assembly 10 of Claim 9 wherein the coolant flow through holes 48 have a 0.190 +/-0.008 inch (0.48 +/- 0.02 cm) or less diameter (page 7, line 6) at their narrowest cross-section.

11. The nuclear fuel assembly 10 of Claim 9 wherein the through coolant flow through holes 48 are packed in a density of about 16 per square inch (page 10. line 18).

12. A debris filter bottom nozzle (page 6, line 2) for a pressurized water nuclear reactor fuel assembly 10 having a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods 22 (page 4, line 31) in an organized array and having unoccupied spaces defined therein (page 6, line 22) adapted to allow flow of fluid coolant therethrough and past said fuel rods 22 when said fuel assembly 10 is installed in the nuclear reactor, a plurality of guide thimbles 18 (page 4, line 26) extending along said fuel rods through and supporting said grid, said debris filter bottom nozzle 12 (page 5, line 25) designed to be disposed below said grid, below lower ends of said fuel rods, to support said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate 46 (page 6, line 5) extending substantially transverse to the axis of the fuel rods and having an upper face to be directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different hole designs, the first hole design 52 (page 7, line 23) being a plurality of holes for receiving lower ends of said guide thimbles where they are to be supported by said plate and the second hole design 54 (page 8, line 6) being a plurality of flow through holes extending completely through said plate for

the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes when incorporated in said fuel assembly, extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and in the extended direction at least some of said coolant flow through holes having a profile substantially of a venturi with flaring at both ends, wherein the flaring at the lower face of said plate 56 (page 8, line 27) comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle (page 9, line 7) than another adjacent chamfer relative to the axial direction of said fuel rods.

13. A fuel assembly 10 (page 4, line 17) for a pressurized water nuclear reactor including a plurality of elongated nuclear fuel rods 22 (page 4, line 31) having an extended axial length, at least a lowermost grid 20 (page 5, line 27) supporting said fuel rods in an organized array and having unoccupied spaces (page 6, line 22) defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly 10 is installed in the nuclear reactor, a plurality of guide thimbles 18 (page 4, line 26) extending along said fuel rods through and supporting said grid, a debris filter bottom nozzle 12 (page 5, line 25) disposed below said grid, below lower ends of said fuel rods, supporting said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate 46 (page 6, line 5) extending substantially transverse to the axis of the fuel rods and having an upper face directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different hole designs, the first hole design 52 (page 7, line 23) being a plurality of holes receiving lower ends of said guide thimbles where they are supported by said plate, the second hole design 54 (page 8, line 6) being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and at least some of said coolant flow through holes having a discrete, double chamfered inlet 56 (page 8, line 27) with each adjacent chamfer of the double chamfered inlet at a different angle (page 9, line 7)

than the other adjacent chamfer relative to the axial direction of said fuel rods.

14. The nuclear fuel assembly 10 of Claim 13 wherein the double chamfered inlet 56 (page 8, line 28) approximates a curved surface.

15. The nuclear fuel assembly 10 of Claim 13 wherein all of the coolant flow through holes 48 (page 8, line 9) not associated with a guide thimble 18 include the double chamfered inlet 56.

16. The nuclear fuel assembly 10 of Claim 13 wherein the chamfers 56 (page 8, line 28) have the following dimensions and angles relative to a flow axis of the flow through hole 54 (page 8, line 6) where Chamfer A is the chamfer closest to an inlet of the flow through hole and Chamfer B is the chamfer adjacent Chamfer A, spaced from the inlet (page 9, line 7).

	Angle	Nominal Length (in.)	Maximum Length (in.)	Minimum Length (in.)
Chamfer A	35° ± 3°	0.017 (0.043 cm)	0.039 (0.099 cm)	0.012 (0.030 cm)
Chamfer B	15° ± 3°	0.039 (0.099 cm)	0.057 (0.145 cm)	0.010 (0.025 cm)

17. The nuclear fuel assembly 10 of Claim 13 wherein the chamfers 56 (page 9, line 11)have the following relative dimensions and angles with regard to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and L/T is the length of the chamfer divided by the thickness of the plate.

	Angle	Chamfer L/T	
		Maximum	Minimum
Chamfer A	2.33 x B	0.071	0.020
Chamfer B	15° +/- 3°	0.104	0.017

Grounds of Rejection to be Reviewed on Appeal

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirements.

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement.

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claims 1, 2 and 7-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger (4,900,507) in view of any of U.S. Patents 4,997,621 to Johansson et al. ('621), U.S. Patent 5,528,640 to Johansson et al. ('640), U.S Patent 5,473,650 to Johansson ('650) or U.S. Patent 5,488,634 to Johansson et al. ('634).

Claims 4, 6 and 13-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger as modified by any of U.S. Patents 4,997,621 to Johansson et al., U.S. Patent 5,528,640 to Johansson et al., U.S Patent 5,473,650 to Johansson or U.S. Patent 5,488,634 to Johansson et al. Further, in view of the teachings of the Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958.

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Claim 5 is rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger and further in view of the teachings of Chapter 42, Fluid Measurements, of The Engineering Handbook, CRC Press LLC, copyright 2000.

Argument

I. Rejections Under 35 U.S.C. §112

A. Claims 1, 2 and 4-17; Rejected Under 35 U.S.C. §112, First Paragraph – Written Description Requirement

Claims 1, 2 and 4-17 were rejected as failing to comply with the written description requirement. The Examiner asserted that the claims contained subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. In this regard, the Examiner asserted that the limitation " . . . concentric countersinks of different included angles and depths into the coolant flow through hole" in Claims 1 and 2 is considered new matter since it is not seen where the specification uses such a phrase in the application as filed.

On page 8 of the specification starting on line 24, the specification states:

> The venturi flow through hole design 54 of the debris filter bottom nozzle 12 was enhanced, from a manufacturing point of view, by optimizing the coolant flow paths through the nozzle flow plate 46. The straight bore flow holes, with single inlet chamfering that was described in the '507 patent [Shallenberger U.S. Patent 4,900,507], was replaced with double inlet chamfers 56 and a single outlet chamfer 58 to form the venturi 54 shown in Figure 5. The angles of the chamfers were optimized to provide the lowest pressure drop. In effect, they approximate a curved surface and streamline the flow through the holes 48. Controlling and inspecting the current geometry is difficult and expensive. The inventors have found, through computational fluid dynamics and experimentation, that as little as two straight chamfers, if configured properly, could develop flow similar to the curved geometry and result in a similar reduced pressure drop, with less cost.

The specific angles and lengths of the chamfers are then set forth in the two tables appearing on page 9 of the specifications and fully define the chamfers. Thus, the specification clearly states that as little as two straight chamfers could develop flow similar to the curved geometry of a normal venturi, with less cost. Though the preferred embodiment employs two inlet chamfers, that does not preclude the use of three chamfers, with the concomitant additional manufacturing costs, provided that they are each straight rather than curved to avoid the additional expense of controlling a curved surface in the manufacturing process.

In a response dated August 30, 2005, an amended Claim 1 described the flow through holes as having a profile substantially of a venturi with flaring at both ends.

wherein the flaring at the lower face of said plate comprises a series of a plurality of discrete chamfers with adjacent chamfers at different angles to the axial direction of the fuel rods. That profile is specifically shown in Figure 5 and described on pages 8 and 9 of the specification, as mentioned above. Nevertheless, the Examiner objected to this language in the Office Action mailed November 16, 2005. In response, Applicants amended Claim 1 in an attempt to cure the Examiner's objections by describing the same flow through profile employing different words to say the same thing. In Claim 1, the phrase "discrete chamfers with adjacent chamfers at different angles to the axial direction of the fuel rods" was changed to "concentric countersinks of different included angles and depths into the coolant flow through hole." Applicants admit that the specification does not use the same exact words as the latter phrase, but it describes the same thing in different terms. Accordingly, the same should not be considered new matter.

The remaining independent Claims 12 and 13 in the response dated April 10, 2006 describe the flaring at the lower face of said plate as comprising "a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of the fuel rods." On page 11 of the Argument Section, Applicants stated that two different approaches were taken in Claims 1 and 12 to describe the flow through hole profile. Applicants considered either the approach of Claim1 or that of Claim 12 to be equivalent in describing the invention. Applicants indicated that they were willing to conform the claims to either approach if the Examiner found either approach acceptable. However, obviously the Examiner did not find either approach acceptable, which is in part the reason for this appeal.

Under Section 112, the Examiner also objected to the phrase " . . . wherein the flaring at the lower face of said plate comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of said fuel rods." The Examiner considered the terms "straight", "adjacent", "each", and "than another adjacent chamfer relative to" as new matter. For the reasons stated above, Applicants assert that these terms are not new matter, but are fully supported by the description provided on pages 8 and 9 of the specification and Figure 5.

B. <u>Claims 1, 2 and 4-17; rejected under 35 U.S.C. §112, First Paragraph – Enablement Requirement</u>

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. In support of this rejection, the Examiner asserted that the limitation " . . . concentric countersinks of different included angles and depths into the coolant flow through hole" had no adequate description nor enabling disclosure in the specification. Similarly, the Examiner asserted that the limitation "wherein the flaring at the lower face of said plate comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of said fuel rods" had no adequate description or enabling disclosure in the specification. The response to the preceding rejection under 35 U.S.C. §112 applies equally as well to this rejection in that pages 8 and 9 of the specification and Figure 5 fully describe the claimed contour of the flow through holes as claimed in Applicants' Claims 1, 2 and 4-17.

C. <u>Claims 1, 2 and 4-17; rejected under 35 U.S.C. §112, second paragraph</u>

Claims 1, 2 and 4-17 are rejected under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In this regard, the Examiner asserted that Claims 1 and 12 are vague, indefinite and incomplete. The Examiner believed it unclear what was encompassed by the limitation "a series" because the figures only show one or two chamfers. The Examiner asserted that the term "series" connotes a broader meaning than the two adjacent chamfers disclosed within the specification. Additionally, the Examiner asserted that "a series of a plurality of discrete chamfers does not connote any particular chamfers, per se; hence the metes and bounds of the claim are undefined."

Webster's New Collegiate Dictionary defines "series" as a number of things or events of the same class coming one after another in spatial or temporal succession. "Plurality" is defined as the state of being plural. "Plural" is defined as relating to or consisting of or containing more than one, or more than one kind or class. The phrase "a series of a plurality" means more than one of a kind placed one after the other. The fact that the figures show only two chamfers should be irrelevant. The figures are used to describe the preferred embodiment, *i.e.*, the preferred mode of practicing the invention, not necessarily the only mode.

Additionally, the Examiner asserted that the phrase "a plurality of discrete chamfers" does not connote any particular chamfers per se, and thus the metes and bounds of the claim are undefined. The word "discrete" is defined by Webster's New Collegiate Dictionary as constituting a separate entity; individually distinct. The term "plurality" was previously defined. The result is more than one distinct chamfer, in this case separated by a change in angle as clearly defined by the angle values set forth on page 9 of the specification.

The Examiner further asserted under this rejection that the phrase "concentric countersinks of different included angles and depths into the coolant flow through hole" was vague and incomplete. The Examiner also objected to the phrase " . . . wherein the flaring at the lower face of said plate comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of said fuel rods." The same objection was made to the phrase "a series of a plurality." These latter three rejections are redundant with those set forth in the above two rejections and the response to those rejections presented above applies equally as well to these rejections.

II. <u>Claim Rejections Under 35 U.S.C. §103</u>

A. Claims 1, 2 and 7-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger (4,900,507) in view of any of U.S. Patents 4,997,621 to Johansson et al. ('621), U.S. Patent 5,528,640 to Johansson et al. ('640), U.S. Patent 5,473,650 to Johansson ('650) or U.S. Patent 5,488,634 to Johansson et al. ('634).

1. <u>Claim 1</u>. As noted in the specification, Claim 1 is an improvement over the Shallenberger design. The improvement comprising wherein at least some of said coolant flow through holes 54 having a profile substantially of a venturi with flaring at both ends, wherein the flaring 56 at the lower face of said plate 46 comprises a series of a plurality of concentric countersinks 56 of different included angles and depths into the coolant flow through hole 54. Shallenberger, as shown by reference character 50 in Figure 7 and the corresponding description in Column 6 starting at Line 56 provides a single inlet chamfer or countersink with no outlet chamfer.

Each of the Johansson et al. references are directed to a boiling water reactor fuel assembly while Applicants' and Shallenberger's inventions are directed to a pressurized water reactor fuel assembly. While the Examiner has not given any patentable weight to the recitation of a pressurized water reactor in the preamble, it should be appreciated that such a recitation modifies each of the elements of the fuel assembly, such as the support grids and control rods, which take on an entirely different form for a pressurized water reactor fuel assembly than they would for a boiling water reactor fuel assembly. The hydrodynamics for the two are completely different because the boiling water reactor fuel assembly is a canned fuel assembly with no cross-flow between assemblies within the core. In contrast, a pressurized water reactor fuel assembly has an open lattice with mixing vanes that promote a cross-flow of coolant among fuel assemblies within the core. Accordingly, the pressure drop experienced in both assemblies is completely different.

It should be appreciated that in a boiling water reactor fuel assembly, the lower nozzle is referred to as the lower tie plate. In the '621 patent, starting at Line 3 in Column 7, the reference states:

> The increased pressure drop through the tie plate causes a more uniform distribution of flow. Referring to Figure 4, the jet coming from the nose piece encounters a higher resistance at the tie plate, which causes the jet to spread to the outer edges of the tie plate. It has been found by experimentation that the high pressure drop lower tie plate disclosed here causes nearly uniform flow across the entire bottom of the fuel bundle. Thus, it will be understood that in addition to providing a greater pressure drop on the passage of the coolant 50 through the lower tie plate L, the disclosed invention utilizes the energy of the pressure drop to produce a more uniform and even flow immediately adjacent the lower tie plate.

Uniform distribution of the flow in a boiling water reactor fuel assembly is particularly important because the fuel assembly is confined at its periphery by the can. Accordingly, there is little, if any, cross-flow among fuel assemblies. This is in

contrast to a pressurized water reactor assembly where cross-flow throughout the assembly and the core is promoted by mixing vanes and open sides between grids. The preferred embodiment of the '621 patent employs a rounded inlet to the flow through holes through the tie plate. In Column 7 starting at Line 24, referring to Figure 5E, the reference describes an alternate embodiment in which:

> The entrance to the lower aperture has a small chamfer 95 instead of a large radius. The small chamfer will cause a greater pressure drop. However, the increase in pressure drop is highly sensitive to the amount of chamfer. Therefore, it is more difficult to obtain a controlled pressure drop than in the preferred embodiment [rounded inlet].

Thus, the objective of the '631 patent in providing a controlled increase in pressure drop to obtain uniform flow is contrary to Applicants' objective of reducing the pressure drop and thus the reference teaches away from Applicants' invention. There is no teaching in the reference of flaring at both ends, nor is there any teaching of the flaring at the lower face of the nozzle plate that comprises a series of a plurality of concentric countersinks of different included angles and depths into the coolant flow through hole. Furthermore, stated another way, there is no teaching in the reference to the coolant flow holes having a discrete, double chamfered inlet with each adjacent chamfer of the double chamfered inlet at a different angle than the other adjacent chamfer relative to the axial direction of said fuel rods.

The '640 patent describes a debris catcher bottom nozzle for a boiling water reactor that is formed by a pair of superposed plates having a plurality of holes of substantially the same size, shape and pitch but wherein the holes of one of the pair of plates are offset from the holes of the other of the pair of plates by 1/2 the hole pitch. While discussing the holes in the plates, the reference states in Column 6 starting at Line 66 that:

> Each hole 44 is essentially square in shape, with rounded corners 56. The holes are arranged in parallel rows in each of two perpendicular directions and are interconnected by a plurality of webs of ligaments 58 of uniform shape and thickness. As best seen in Figure 6, the webs or ligaments 58 have rounded upper and lower edges 60, 62, respectively, for minimization of flow resistance.

Figure 13 best shows the offset between the upper and lower flow channels that are defined by the webs 58 and 80 with a Gap there between. As explained in Column 7 starting at Line 45, the Gap controls the extent of pressure drop. As with the '621 reference. the '640 reference recognizes the need in a BWR to maintain the pressure drop where it states in Column 2 starting at Line 55 that:

> Finally, through the fuel bundle itself – from the exit of the lower tie plate assembly to the exit at the upper tie plate assembly – about 11 psi of pressure drop usually occurs. When new fuel bundles are introduced into the reactor core, these flow resistances <u>must be preserved</u> [emphasis added]. Otherwise, the coolant/moderator flow distribution could be compromised among the various types of fuel in the reactor core.

It should be noted that the '640 patent also teaches square channels rather than the rounded channel of a venturi (Column 6 starting at Line 66.) The reference thus not only teaches away from Applicants' invention, the flow through holes of the '640 reference do not have a profile substantially of a venturi and definitely do not have a flaring at the lower face of the nozzle comprising a series of a plurality of concentric countersinks of different included angles and depths. Furthermore, the reference does not teach that the flaring of the lower face of the nozzle plate comprise a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of said fuel rods.

The '650 patent also teaches a boiling water reactor tie plate having openings for the flow of coolant. The patent also acknowledges the need to maintain a relatively large pressure drop to assure the uniform distribution of coolant moderator

flow through the many fuel bundles within the core. The patent recognizes changes that have been made to improve the fuel assemblies over time, such as increasing the number of fuel rods with reduced diameters, that results in an increase in pressure drop within the main portion of the assembly. Therefore, the '650 reference strives to make up for that increased pressure drop by reducing the pressure drop within the lower tie plate. The flow through openings are formed in the lower surface of the tie plate between bosses 36 that support the fuel rods. The bosses are connected by webs 38 that have the flow through openings 42 defined in part by convex portions of adjacent bosses, and intervening web portion between the adjacent bosses, marginal edges of a pair of ribs 52 and the marginal edges of the ribs 54 (Column 8, Lines 7 *et seq.*) The openings 42 are generally U-shaped in plan. The legs of the generally U-shaped opening extend toward the center of the square matrix defined by the bosses 36 or towards the center of the central region 50, which is the hub of the web 38 (Column 8, Lines 17-22). Below the throat 56, which is defined as the narrowest point of the flow through opening 42, and at the entrance of each of the openings 42, there is provided a radius 58 along the margin of each U-shaped opening (Column 8, Line 29-31). Thus the flow through openings of the '650 patent are not venturi-like at all, but merely have rounded edges at the inlets.

The '634 patent also describes a unitary one-piece lower tie plate grid for a boiling water reactor, having a lower portion and an upper portion for supporting the fuel rods. The lower tie plate grid includes cylindrical boss portions extending upwardly from the lower grid portion and arranged in square matrices for receiving the lower end plugs of the fuel rods. Web portions extending upwardly from the lower tie plate portion interconnect the boss portions along the sides of the matrices much like the '650 patent. The lower grid portions include a plurality of openings

which open into the flow spaces defined by the convex portion of the bosses and the webs within each square matrix of the upper portion of the tie plate. Coolant flows through the openings into the flow spaces for further flow upwardly about the fuel rods. The openings are radiused adjacent their lower ends and have divergent sidewalls downstream of the throat area to define a flow venturi. However, the profile of the venturi does not have flaring ends wherein the flaring at the lower face of the tie plate comprises a series of a plurality of concentric countersinks of different included angles and depths into the coolant flow through hole. In paragraph 7 of the Office Action of November 16, 2005, which the Examiner incorporated by reference into the Office Action of July 18, 2006. the Examiner relied upon Figure 5 of the '634 patent, Figures 13, 15, 17 of the '640 patent, Figure 5 of the '650 patent and Figure 5E of the '621 patent as showing discrete chamfers at the inlet of the flow through hole. With one exception, each of the cited figures shows a rounded inlet which is clearly not formed from a series of a plurality of concentric countersinks of different included angles and depths into the coolant flow through hole. The one exception is Figure 5E of the '621 patent which shows a single chamfer at the inlet and accordingly, does not meet this limitation as well.

The Examiner relies upon the argument that the curved surface is made up of a large number of straight, discrete, adjacent points and therefore falls within the scope of the claim language. While Claim 1 has been amended to recite in different terms the same structure, the original language of Claim 1 appears in varying forms in independent Claims 12 and 13. Thus, it is worthwhile addressing the Examiner's argument. While the curved surface may be made up of an infinite number of points, and while the tangent of any of those points might be considered straight, the curve itself is not made up of a plurality of straight, discrete, adjacent chamfers and it is

believed a stretch of the definition of chamfer to call any of those points a chamfer. A "chamfer" is defined in Webster's New Collegiate Dictionary as a beveled edge.

2. Claim 2. Claim 2 is dependent on Claim 1 and further defines the flow through hole as having a chamfer in the outlet end. As previously stated, Shallenberger shows a single chamfer at the inlet with no chamfer at the outlet. Neither the '621 patent, the '650 patent, the '634 patent or the '640 patent describe, teach or show a chamfer at the outlet. The closest art is found in Figure 5D of the '621 patent which shows a chamfer slightly less than midway through the flow through hole. Thus, the reference does not teach a chamfer at the outlet. The corresponding discussion can be found in Column 7 starting at Line 17, which is a continuation of a discussion of a variation of a two-step flow hole that is started in Column 6 starting at Line 28. Accordingly, Claim 2 distinguishes for the individual limitation that introduces and should be considered patentable over the references.

3. Claims 7-11. Claims 7-11 are either directly or indirectly dependent upon Claim 1 and distinguish over the references for the reasons given with regard to Claim 1.

4. Claim 12. Claim 12 calls for a debris filter bottom nozzle with flow through holes having a profile substantially of a venturi with flaring at both ends wherein the flaring at the lower face comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of said fuel rods. Thus, Claim 12 calls for the same flow through hole profile described in Claim 1, in different terms, and therefore distinguishes for the reasons previously noted for Claim 1.

B. Claims 4, 6 and 13-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger as modified by any of the '621, '640, '650, or '634

patents as applied to Claims 1, 2 and 7-12 above, further in view of the teachings of the Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958. The relevant teachings of Shallenberger and the Johansson et al. references have been fully set forth above. As previously stated, Figure 7 of Shallenberger and Figure 5E of the '621 patent are the closest art cited in that they each show a single inlet chamfer and none of the references thus far applied show an outlet chamfer. The Mechanical Engineers' Handbook section referenced discusses the properties of liquids in motion and general considerations regarding flow. The sections cited by the Examiner more particularly deal with discharges through nozzles and make short references to a venturi meter. The corresponding passages discuss the velocity head and flow through different nozzles. On page 3-63, the reference discusses the value of an average good, smooth, rounded orifice as compared to one of poor curvature, with one of poor curvature causing contraction and cross currents with a significantly lower Hamilton Smith's coefficient. On page 3-64, the reference discusses that rounding or beveling a sharp upstream edge even slightly increases the discharge of an orifice. On the same page, the sections on "Obtainable Precision" and "Submergence or Discharge Under Water" show that the upstream environment of an orifice significantly affects the discharge and flow characteristics. Nothing in the cited text would lead one of ordinary skill to apply a venturi design to the lower nozzle of a fuel assembly. However, if one did, the Mechanical Engineers' Handbook would validate the approach taken in the Johansson et al. references in providing a rounded inlet and outlet. There is no mention in any of the reference of employing a multiple chamfered inlet in combination with a chamfered outlet. Furthermore, none of the references teach the impact of such a design on the manufacturing process.

1. Claim 4. Claim 4 is dependent upon Claim 1 and distinguishes over Shallenberger and the Johansson references for the reasons noted above. As stated in the previous paragraph, the Mechanical Engineers' Handbook does not cure the deficiencies previously noted for Shallenberger and the Johansson et al. references.

2. Claim 6. Claim 6 is dependent upon Claim 4 and specifies the specific angles of the chamfers with regard to the axis of flow, which is neither described, taught or shown in Shallenberger or in any of the Johansson et al. references, nor described in the Mechanical Engineers' Handbook. As mentioned at the bottom of page 8 and the top of page 9 of the specification, the inventors have found through computational fluid dynamics and experimentation that as little as two straight chamfers, if configured properly, could develop flow similar to the curved geometry and result in a similar reduced pressure drop, with much less manufacturing cost. None of these angles are described, shown or taught in any of the foregoing references.

3. Claim 13. Claim 13 is an independent claim that calls for at least some of the coolant flow through holes having a discrete double chamfered inlet with adjacent chamfers at different angles to the axial direction of the fuel rods. As previously stated, none of the cited references to Shallenberger, Johansson et al. or the Mechanical Engineers' Handbook show the combination of a double chamfered inlet and chamfered outlet. Accordingly, Applicants' Claim 13 should not be considered obvious over the reference.

4. Claims 14 and 15. Claim 14 is dependent upon Claim 13 and calls for the double chamfered inlet approximating a curved surface. Claim 15 is dependent upon Claim 13 and further defines that all of the coolant flow holes not

associated with a guide thimble include the double chamfered inlet. Claims 14 and 15 distinguish for the reasons noted for Claim 13 and should be similarly allowable.

5. Claims 16 and 17. Claims 16 and 17 are dependent upon Claim 13 and set forth the specific angles of the chamfers. As stated with regard to Claim 6, none of these angles are described, taught or shown in any of the cited references. Accordingly, Claims 16 and 17 should be allowable for the individual limitations that they introduce.

C. Claims 1, 2, 4 and 6-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger in view of either the Mechanical Engineering Handbook, CRC Press LLC, copyright 1999, or the Industrial Burners Handbook, CRC Press LLC, copyright 2003, or the Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc. copyright 1958.

The cited section in the Mechanical Engineering Handbook, CRC Press LLC, copyright 1999, is entitled "Venturis" in the chapter on Fluid Dynamics. The excerpt provided by the Examiner is a small portion of that section and does not give the entire context. The first paragraph reads:

> Venturi meters are generally made from castings machined to close tolerances to duplicate the performance of the standard design, so they are heavy, bulky, and expensive. The conical diffuser section downstream from the throat gives excellent pressure recovery; overall head loss is low. Venturi meters are self-cleaning because of their smooth internal contours.

The remaining paragraph and a half discusses the high discharge coefficients and the sizing of the meter. It is not clear from any of these teachings that the benefits of a conical diffuser section at the outlet would not be negated by the obstruction of the lower-most grid in the path of the exiting flow. There is clearly no teaching or suggestion in the excerpt of the Mechanical Engineering Handbook, CRC Press LLC, 1999, to employing a conical diffuser section to the outlet of a flow through hole in

the lower nozzle of a pressurized water reactor fuel assembly. Furthermore, there is no teaching or suggestion in Shallenberger to such an arrangement nevertheless in combination with a multiple chamfered inlet as called for in Applicants' claims.

While the Industrial Burners Handbook, CRC Press LLC, copyright 2003 discusses fluid flow in Chapter 3, it does so in an entirely different environment. It is respectfully asserted that one of ordinary skill in the nuclear art would not go to the Industrial Burners Handbook for ideas to resolve issues for pressure drop in the lower nozzle of a pressurized water reactor fuel assembly. Nevertheless, for the purpose of this response, the relevant Section 3.3.3 will be discussed. The section discusses the eduction process commonly carried out by systems known as eductors or jet pumps. Jet pumps are not commonly used within the core of a pressurized water reactors, though they are employed within the reactor vessels of boiling water reactors. The reference states that it is common to see more complex venturi designs in the burner art. The inlet typically consists of a well-rounded bell design to reduce pressure losses as the secondary gas enters into the eductor system. Reducing pressure losses improves entrainment performance which can be critical to pre-mixed burners. The relative dimensions of the venturi throat downstream of the inlet is also critical to the entrainment performance of the eductor system. Located just downstream of the venturi throat is the diffuser section, which is conical in shape and provides a transition from the venturi throat to the downstream section. Typically, diffusers are designed with small transition angles to provide smooth flow in order to reduce the pressure losses as gas flows from the throat to the downstream section. The downstream section can be a straight pipe or can be quite complex, consisting of a variety of fittings. The reference states:

> Usually, in the burner industry, the outlet of the downstream section consists of a tip. There are a variety of tips used in the burner industry, depending on the design application. The pressure loss associated with the flowing gas through the downstream section and tip can have a major influence on the design and performance of an eductor system.

It's not clear what the Industrial Burners Handbook adds to the teachings provided by the Mechanical Engineering Handbook, CRC Press LLC, 1999. The Mechanical Engineers' Handbook, Sixth Edition, McGraw-Hill Book Company, Inc. copyright 1958, has already been discussed above. The Tucker et al. reference is concerned with maintaining a laminar flow in an elongated fluid passage within a device with parallel opposed sides and a flared entry portion leading to a portion of constant cross-section. The device is employed for measuring fluid flow rate and/or viscosity. The device is said to differ from other known apparatus in that the geometry of the entry portion into a substantially constant cross-section passage or passages is defined in terms of a "figure of merit" by means of a test which may be readily conducted by those skilled in the art. The figure of merit can determine the relative suitability of the inlet design for maintaining laminar flow through the long section of constant cross-section. Figures 5 to 16 are section side views of different entry portions to that of Figure 2, some of which are suitable and others of which are unsuitable for use with the Tucker invention. Figure 2 shows a flared rounded entry portion 12. Figure 11 shows a single chamfered inlet and the corresponding description in Column 17 starting at Line 37 states:

> In Figure 11, there is shown a fluid passage 2 in accordance with the present invention having a chamfered inlet portion. Any depth D will give an improvement over the squared inlet portion shown in Figure 8. Figures 13, 14 and 16 show that any rounding of the chamfered section provides further improvement over the squared inlet portion shown in Figure 8.

Figure 15 of the reference shows a double chamfered inlet and states in Column 17 starting at Line 63 that:

> In Figure 15 there is shown a fluid passage 2 according to the present invention having a double chamfered inlet portion with upstream angle having a steeper angle than the downstream chamfer. Such double chamfering of the inlet would also improve the figure of merit relative to the entry portion in Figure 11 provided that the angle of the second chamfer is not steeper than the angle of the single chamfer of Figure 11.

Figure 16 shows a flared entry portion where the radius of curvature of the flare changes in magnitude over at least a portion of the inlet length. The reference states that the flow velocity gradients throughout the flared entry portion may be minimized by appropriately contouring the inlet portion in this manner. The gradual and continuous increase in the radius of curvature of the flare in the direction for fluid flow gives good results in terms of the figure of merit.

Thus, even if one was to apply the teachings of Tucker et al. to Shallenberger, Tucker et al. would lead one to the use of rounded inlets as provided in Johansson et al. It does not appear that the outlet was a consideration of Tucker et al.'s

Accordingly, Claims 1, 2, 4 and 6-17, which were discussed above, should not rightfully be considered obvious over Shallenberger, in view of the <u>Mechanical Engineering Handbook</u>, CRC Press LLC, copyright 1999, or the <u>Industrial Burners Handbook</u>, CRC Press LLC, copyright 2003, or the <u>Mechanical Engineers' Handbook</u>, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958, and further in view of either <u>Mechanical Engineers' Handbook</u>, Sixth Edition, McGraw-Hill Book Company, Inc., copyright 1958 or Tucker, et al.

D. <u>Claim 5</u>. Claim 5 is rejected under 35 U.S.C. §103(a) as being unpatentable over Shallenberger in view of the teachings of Chapter 42, Fluid Measurements of the <u>Engineering Handbook</u>, CRC Press LLC, copyright 2000. Claim 5 specifies the specific angles of the chamfers relative to the axis of flow. The Examiner asserted that the inlet Chamfer A falls within the range set forth in

Shallenberger in the rejection of Section 10 of the Office Action. Shallenberger discloses a single inlet chamfer forming an angle of about 12-15°. Chamfer A, which is located directly at the inlet and corresponds most closely to Shallenberger's chamfer, is specified in Claim 5 to be approximately 35°. As previously stated, Shallenberger does not describe, teach or show a double chamfered inlet. The only chamfered inlet shown in the Johansson et al. patents is provided with regard to Figure 5E in the '621 patent which also shows a single chamfered inlet; however, no angle of the chamfer is described, taught or shown. The Mechanical Engineers' Handbook, copyright 1958, does not discuss any chamfer angles. The only reference to double chamfer angles is not found in the references cited in Section 10 of the Office Action but may be found in Tucker et al. with regard to the description of Figure 15 in Column 17 starting at Line 66 where the reference states:

> Such double chamfering of the inlet portion would also improve the figure of merit relative to the entry portion in Figure 11 provided that the angle of the second chamfer is not steeper than the angle of the single chamfer of Figure 11.

The angle of the single chamfer of Figure 11 is not disclosed. However, the single chamfer of Shallenberger is about 12-15° while the second chamfer of Claim 5 may be between 12 and 18°. Accordingly, the second chamfer of Claim 5 may well be steeper than the single chamfer of Shallenberger, contrary to the teachings of Tucker et al. Furthermore, the teachings of the angle of the diffuser between 5 and 15° in the Engineering Handbook, CRC Press LLC, 2000, is not at the outlet as called for in Claim 5. Accordingly, Claim 5 should not rightfully be considered obvious over Shallenberger, and further in view of the teachings of Chapter 42, Fluid Measurements, of The Engineering Handbook, CRC Press LLC, copyright 2000.

III. Criteria for Rejections Under 35 U.S.C. §103(a)

A. Authority

The three-pronged test required for finding a *prima facie* case of obviousness under 35 U.S.C. §103(a) is:

1. First, there must be some suggestion or motivation, either in the references themselves. or the knowledge of one skilled in the art, to modify the references or to combine reference teaching;

2. Second, there must be a reasonable expectation of success; and finally,

3. The prior art references must teach or suggest all the claimed limitations.

Each of these three prongs must be found in the prior art and not based on Applicant's disclosure. *In Re: Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); M.P.E.P.2142.

The initial burden is on the Examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." *Ex Parte Clapp*, 227 USPQ 972. 973 (Board of Appeals and Interferences 1985); M.P.E.P.2142. In the foregoing arguments, Applicants have shown where the Examiner has not carried that burden.

The Court of Appeals for the Federal Circuit in *In Re Bell,* 991 F.2d 781, 26 USPQ2d 1529 (C.A.F.C. 4/20/93) stated:

> Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination.

The Court of Appeals for the Federal Circuit further stated in *In Re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (C.A.F.C. 8/11/92) that:

> The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification . . . here, the Examiner relied upon hindsight to arrive at the determination of obvious. It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This Court has stated that "[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

It is respectfully asserted that the Examiner is using hindsight reconstruction to pick and choose among isolated disclosures in the many pieces of prior art the Examiner has cited to deprecate the claimed invention, which should be, and is, impermissible.

In further support of Applicants' position with regard to the objections raised by the Examiner under 35 U.S.C. §112. the district court stated in *Advanced Cardiovascular Systems v. Scimed Life Systems*, 96 F.Supp.2d 1006, N.D.Calif. (decided 4/25/00) that:

> A patent claim is sufficiently definite if those skilled in the art would understand what is claimed when the claim is read in light of the specification . . . mathematical precision should not be imposed for its own sake; a patentee has the right to claim the invention in terms that would be understood by persons of skill in the field of the invention.

Additionally, the Court of Appeals for the Federal Circuit in *Dental Prodx LLC v. Advantage Dental Products, Inc.*, 309 F.3d 774, 64 USPQ2d 1945 (10/25/02) held that:

> Failure of a specification to specifically mention a limitation that later appears in the claims is not fatal if a person skilled in the art would recognize, upon reading the specification, that the new language reflects what the specification shows has been invented.

Furthermore, with regard to the limitation of a pressurized water reactor within the preamble of the claim, the Federal Circuit has held that a patent claim preamble limits claim scope if it recites essential structure that is important to the invention or necessary to give meaning to the claim. *Bicon, Inc. v. Straumann,* 441 F.3d 945, 78 USPQ 1267 (C.A.F.C. 3/20/06).

B. Declaration.

In paragraph 1 of the Office Action, the Examiner reaffirms his position of not giving any patentable weight to the original and supplemental 132 declarations of Michael Y. Young as being opinionated declarations. In the original declaration, Mr. Young set forth his credentials as an expert in fuel assembly manufacture. In a supplemental declaration dated April 6, 2006, Mr. Young specifically stated in paragraph 7 that Westinghouse's test results have shown that the double chamfered inlet of the instant invention has been found not to adversely impact the benefit of the venturi profile in the bottom nozzle coolant flow holes, but provides a significant manufacturing savings over the normal venturi gradient profile between the inlet and outlet of the venturi flow holes. In refusing to give patentable weight to Mr. Young's statements, the Examiner is substituting his opinion for the opinion of an expert.

In the Board of Appeals and Interferences decision in *Ex Parte Bruce A. Green and Gary W. Zlotnick* (Appeal No. 94-161A), the Board stated, "The Examiner's opinion to the contrary is just that, opinion, which the Examiner erroneously substitutes for that of an expert in the art" citing *In Re Zeidler*, 682 F.2d 961, 967, 215 USPQ 490, 494 (C.C.P.A. 1982). Furthermore, Section 7 of Mr. Young's supplemental declaration, as well as many of the other sections of the declaration, are not merely statements of opinion, but are sworn statements of fact.

Conclusion

Accordingly, in view of the foregoing, Appellants respectfully request that the Board reverse the Examiner's rejections under 35 U.S.C. §§112 and 103(a). It is submitted that Claims 1-2 and 4-17 are patentable over the prior art and satisfy the formal requirements of the patent laws. Therefore, it is requested that the Board reverse the Examiner's rejections of Claims 1-2 and 4-17 and remand the application to the Examiner for the issuance of a Notice of Allowance.

Respectfully submitted,

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CLAIMS APPENDIX

Listing of Claims:

1. A fuel assembly for a pressurized water nuclear reactor including a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods in an organized array and having unoccupied spaces defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly is installed in the nuclear reactor and a plurality of guide thimbles extending along said fuel rods through and supporting said grid, a debris filter bottom nozzle disposed below said grid, below lower ends of said fuel rods, supporting said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate extending substantially transverse to the axis of the fuel rods and having an upper face directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different hole designs, the first hole design being a plurality of holes receiving lower ends of said guide thimbles where they are supported by said plate and the second hole design being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces. and in the extended direction at least some of said coolant flow through holes having a profile substantially of a venturi with flaring at both ends, wherein the flaring at the lower face of said plate comprises a series of a plurality of concentric countersinks of different included angles and depths into the coolant flow through hole.

2. The nuclear fuel assembly of Claim 1 wherein said coolant flow through holes having a profile substantially of a venturi have an inlet end in the lower face of said plate and an outlet end in the upper face of said plate wherein the venturi is substantially formed by the concentric countersinks of different included angles and depths into the coolant flow through hole in said inlet and a chamfer in said outlet end.

3. (canceled)

4. The nuclear fuel assembly of Claim 1 wherein the inlet chamfers approximates a curved surface.

5. The nuclear fuel assembly of Claim 4 wherein the chamfers have the following dimensions and angles relative to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes.

	Angle	Nominal Length (in.)	Maximum Length (in.)	Minimum Length (in.)
Chamfer A	35° ± 3°	0.017 (0.043 cm)	0.039 (0.099 cm)	0.012 (0.030 cm)
Chamfer B	15° ± 3°	0.039 (0.099 cm)	0.057 (0.145 cm)	0.010 (0.025 cm)
Chamfer C	10° ± 3°	0.085 (0.361 cm)	0.142 (0.361 cm)	0.059 (1.397 cm)

6. The nuclear fuel assembly of Claim 4 wherein the chamfers have the following relative dimensions and angles with regard to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes and L/T is the length of the chamfer divided by the thickness of the plate.

	Angle	Chamfer L/T	
		Maximum	Minimum
Chamfer A	2.33 x B	0.071	0.020
Chamfer B	15° +/- 3°	0.104	0.017
Chamfer C	0.67 x B	0.258	0.101

7. The nuclear fuel assembly of Claim 1 wherein substantially every coolant flow through hole not associated with a guide thimble has the venturi profile in the extended direction.

8. The nuclear fuel assembly of Claim 1 including support means adapted to support said fuel assembly when installed in the nuclear reactor with said plate fixed at its periphery on said support means.

9. The nuclear fuel assembly of Claim 1 wherein the coolant flow through holes have a substantially circular cross-section.

10. The nuclear fuel assembly of Claim 9 wherein the coolant flow through holes have a 0.190 +/-0.008 inch (0.48 +/- 0.02 cm) or less diameter at their narrowest cross-section.

11. The nuclear fuel assembly of Claim 9 wherein the through coolant flow through holes are packed in a density of about 16 per square inch.

12. A debris filter bottom nozzle for a pressurized water nuclear reactor fuel assembly having a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods in an organized array and having unoccupied spaces defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly is installed in the nuclear reactor, a plurality of guide thimbles extending along said fuel rods through and supporting said grid, said debris filter bottom nozzle designed to be disposed below said grid, below lower ends of said fuel rods, to support said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate extending substantially transverse to the axis of the fuel rods and having an upper face to be directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different hole designs, the first hole design being a plurality of holes for receiving lower ends of said guide thimbles where they are to be supported by said plate and the second hole design being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes when incorporated in said fuel assembly, extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and in the

extended direction at least some of said coolant flow through holes having a profile substantially of a venturi with flaring at both ends, wherein the flaring at the lower face of said plate comprises a series of a plurality of straight, discrete, adjacent chamfers with each adjacent chamfer at a different angle than another adjacent chamfer relative to the axial direction of said fuel rods.

13. A fuel assembly for a pressurized water nuclear reactor including a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods in an organized array and having unoccupied spaces defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly is installed in the nuclear reactor, a plurality of guide thimbles extending along said fuel rods through and supporting said grid, a debris filter bottom nozzle disposed below said grid, below lower ends of said fuel rods, supporting said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate extending substantially transverse to the axis of the fuel rods and having an upper face directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different hole designs, the first hole design being a plurality of holes receiving lower ends of said guide thimbles where they are supported by said plate, the second hole design being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and at least some of said coolant flow through holes having a discrete, double chamfered inlet with each adjacent chamfer of the double chamfered inlet at a different angle than the other adjacent chamfer relative to the axial direction of said fuel rods.

14. The nuclear fuel assembly of Claim 13 wherein the double chamfered inlet approximates a curved surface.

15. The nuclear fuel assembly of Claim 13 wherein all of the coolant flow through holes not associated with a guide thimble include the double chamfered inlet.

16. The nuclear fuel assembly of Claim 13 wherein the chamfers have the following dimensions and angles relative to a flow axis of the flow through hole where Chamfer A is the chamfer closest to an inlet of the flow through hole and Chamfer B is the chamfer adjacent Chamfer A, spaced from the inlet.

	Angle	Nominal Length (in.)	Maximum Length (in.)	Minimum Length (in.)
Chamfer A	35° ± 3°	0.017 (0.043 cm)	0.039 (0.099 cm)	0.012 (0.030 cm)
Chamfer B	15° ± 3°	0.039 (0.099 cm)	0.057 (0.145 cm)	0.010 (0.025 cm)

17. The nuclear fuel assembly of Claim 13 wherein the chamfers have the following relative dimensions and angles with regard to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and L/T is the length of the chamfer divided by the thickness of the plate.

	Angle	Chamfer L/T	
		Maximum	Minimum
Chamfer A	2.33 x B	0.071	0.020
Chamfer B	15° +/- 3°	0.104	0.017

EVIDENCE APPENDIX

WEBSTER'S New Collegiate Dictionary

A Merriam-Webster®

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chal·lis \'shal-ē\ n, pl chal·lises \-ēz\ [prob. fr. the name Challis] : a lightweight soft clothing fabric made of cotton, wool, or synthetic yarns
cha·lone \'kā-,lōn, 'kal-,ōn\ n [Gk chalōn, prp. of chalan to slacken] : an internal secretion that depresses activity — compare HORMONE
cha·ly·be·ate \kə-'lib-ē-ət, -'lē-bē-\ adj [prob. fr. NL chalybeatus, irreg. fr. L chalybs steel, fr. Gk chalyb-, chalyps, fr. Chalybes, ancient people in Asia Minor] : impregnated with salts of iron; also : having a taste due to iron ⟨~ springs⟩
chalybeate n : a chalybeate liquid or medicine
cham \'kam\ var of KHAN
cham·ae·phyte \'kam-i-,fīt\ n [Gk chamai on the ground + E -phyte — more at HUMBLE] : a perennial plant that bears its overwintering buds just above the surface of the soil
1cham·ber \'chām-bər\ n [ME chambre, fr. OF, fr. LL camera, fr. L, arched roof, fr. Gk kamara vault; akin to L camur curved] 1 : ROOM; esp : BEDROOM 2 : a natural or artificial enclosed space or cavity 3 a : a hall for the meetings of a deliberative, legislative, or judicial body ⟨the senate ~⟩ b : a room where a judge transacts business — usu. used in pl. c : the reception room of a person of rank or authority 4 a : a legislative or judicial body; esp : either of the houses of a bicameral legislature b : a voluntary board or council 5 a : the part of the bore of a gun that holds the charge b : a compartment in the cartridge cylinder of a revolver
2chamber vt cham·bered; cham·ber·ing \-b(ə-)riŋ\ 1 : to place in or as if in a chamber : HOUSE 2 : to serve as a chamber for; esp : to accommodate in the chamber of a firearm
3chamber adj : being, relating to, or performing chamber music
cham·bered \'chām-bərd\ adj : having a chamber ⟨the ~ nautilus⟩
1chamberer n, obs : CHAMBERMAID
2cham·ber·er \'chām-bər-ər\ n [ME, chamberlain, fr. MF chamberier, fr. LL camerarius, fr. camera] archaic : GALLANT, LOVER
cham·ber·lain \'chām-bər-lən\ n [ME, fr. OF chamberlayn, of Gmc origin; akin to OHG chamarling chamberlain, fr. chamara chamber, fr. LL camera] 1 : an attendant on a sovereign or lord in his bedchamber 2 a : a chief officer in the household of a king or nobleman b : TREASURER 3 : an often honorary papal attendant; specif : a priest having a rank of honor below domestic prelate
cham·ber·maid \-,mād\ n : a maid who makes beds and does general cleaning of bedrooms (as in a hotel)
chamber music n : music and esp. instrumental ensemble music intended for performance in a private room or small auditorium and usu. having one performer for each part
chamber of commerce : an association of businessmen to promote commercial and industrial interests in the community
chamber of horrors : a hall in which objects of macabre interest (as instruments of torture) are exhibited; also : a collection of such exhibits
chamber orchestra n : a small orchestra usu. with one player for each instrumental part
chamber pot n : a bedroom vessel for urine and feces
cham·bray \'sham-,brā, -brē\ n [irreg. fr. Cambrai, France] : a lightweight clothing fabric with colored warp and white filling yarns
cha·me·leon \kə-'mēl-yən\ n [ME camelion, fr. MF, fr. L chamaeleon, fr. Gk chamaileōn, fr. chamai on the ground + leōn lion — more at HUMBLE] 1 : any of a group (Rhiptoglossa) of Old World lizards with granular skin, prehensile tail, independently movable eyeballs, and unusual ability to change the color of the skin 2 : a fickle or changeable person or thing 3 : any of various American lizards (as of the genus Anolis) capable of changing their color; esp : AMERICAN CHAMELEON — cha·me·le·on·ic \-,mē-lē-'än-ik\ adj
1cham·fer \'cham(p)-fər, 'cham-pər\ n [MF chanfreint, fr. pp. of chanfraindre to bevel, fr. chant edge (fr. L canthus iron tire) + fraindre to break, fr. L frangere — more at CANT, BREAK] : a beveled edge
2chamfer vt cham·fered; cham·fer·ing \-f(ə-)riŋ, -p(ə-)riŋ\ 1 : to cut a furrow in (as a column) : GROOVE 2 : to make a chamfer on : BEVEL
cham·fron \'sham-frən, 'cham-\ n [ME shamfron, fr. MF chanfrein] : the headpiece of a horse's bard
cham·ois \'sham-ē, in sense 1 also sham-'wä\ n, pl cham·ois also cham·oix \in sense 1 'sham-ē(z) or sham-'wä(z), in sense 2 'sham-ēz\ [MF, fr. LL camox] 1 : a small goatlike antelope (Rupicapra rupicapra) of Europe and the Caucasus 2 also cham·my or sham·my \'sham-ē\ a : a soft pliant leather prepared from the skin of the chamois or from sheepskin

chamois 1

cham·o·mile \'kam-ə-,mīl, -,mēl\ n [ME camemille, fr. ML camomilla, modif. of L chamaemelon, fr. Gk chamaimēlon, fr. chamai + mēlon apple] 1 : any of a genus (Anthemis, esp. the common European A. nobilis) of composite herbs with strong-scented foliage and flower heads that contain a bitter medicinal principle 2 : a similar plant of a related genus (Matricaria)
champ \'champ, 'chämp, 'chòmp\ vb [perh. imit.] vt 1 : CHOMP 2 : TRAMPLE ~ vi 1 : to make biting or gnashing movements 2 : to show impatience of delay or restraint — usu. used in the phrase champing at the bit ⟨the children were ~ing at the bit to ...⟩
champ \'champ\ n : CHAMPION
cham·pac or cham·pak \'cham-,pak, 'chəm-(,)pək\ n [Hindi & Beng campak, fr. Skt campaka] : an East Indian tree (Michelia champaca) of the magnolia family with yellow flowers
cham·pagne \sham-'pān\ n [F, fr. Champagne, France] 1 : a white sparkling wine made in the old province of Champagne, France; also : a similar wine made elsewhere 2 : a pale orange yellow to light grayish yellowish brown
cham·paign \sham-'pān\ n [ME champaine, fr. MF champagne, fr. LL campania — more at CAMPAIGN] 1 : an expanse of level open country : PLAIN 2 archaic : BATTLEFIELD — champaign adj
cham·per·ty \'cham-pərt-ē\ n [ME champartie, fr. MF champart field rent, fr. champ field (fr. L campus) + part portion — more at CAMP, PART] : a proceeding by which a person not a party in a suit bargains to aid in or carry on its prosecution or defense in consideration of a share of the matter in suit — cham·per·tous \-pərt-əs\ adj
cham·pi·gnon \sham-'pin-yən, cham-\ n [MF, fr. champagne] : an edible fungus; esp : the common meadow mushroom (Agaricus campestris)
1cham·pi·on \'cham-pē-ən\ n [ME, fr. OF, fr. ML campion-, campio, of WGmc origin] 1 : WARRIOR, FIGHTER 2 : a militant advocate or defender ⟨an outspoken ~ of civil rights⟩ 3 : one that does battle for another's rights or honor ⟨God will raise me up a ~ —Sir Walter Scott⟩ 4 : a winner of first prize or first place in competition; also : one who shows marked superiority ⟨a ~ at telling stories⟩
2champion vt 1 archaic : CHALLENGE, DEFY 2 : to protect or fight for as a champion 3 : to act as militant supporter of : UPHOLD ⟨always ~s the cause of the underdog⟩ syn see SUPPORT
cham·pi·on·ship \-,ship\ n 1 : designation as champion 2 : the act of championing : DEFENSE ⟨his ~ of freedom of speech⟩ 3 : a contest held to determine a champion
champ·le·vé \,shäⁿl-ə-'vā\ adj [F] : of, relating to, or being a style of enamel decoration in which the enamel is applied and fired in cells depressed (as by incising) into a metal background — compare CLOISONNÉ — champlevé n
chan abbr channel
1chance \'chan(t)s\ n [ME, fr. OF, fr. (assumed) VL cadentia fall, fr. L cadent-, cadens, prp. of cadere to fall; akin to Skt śad to fall] 1 a : something that happens unpredictably without discernible human intention or observable cause b : the assumed impersonal purposeless determiner of unaccountable happenings : LUCK c : the fortuitous or incalculable element in existence : CONTINGENCY 2 : a situation favoring some purpose : OPPORTUNITY ⟨the weekend gives him a ~ to relax⟩ 3 : a fielding opportunity in baseball 4 a : the possibility of an indicated or a favorable outcome in an uncertain situation; also : the degree of likelihood of such an outcome ⟨we have almost no ~ of winning⟩ b pl : the more likely indications ⟨~s are he's already heard the news⟩ 5 a : RISK ⟨took a ~ and guessed at the answer⟩ b : a ticket in a raffle — chance adj — by chance : in the haphazard course of events ⟨they met by chance but parted by design⟩
2chance vb chanced; chanc·ing vi 1 a : to take place or come about by chance : HAPPEN b : to be found by chance c : to have the good or bad luck 2 : to come or light by chance ~ vt 1 : to leave the outcome of to chance 2 : to accept the hazard of : RISK syn see HAPPEN
chance·ful \'chan(t)s-fəl\ adj 1 archaic : CASUAL 2 : EVENTFUL
chan·cel \'chan(t)-səl\ n [ME, fr. MF, fr. LL cancellus lattice, fr. L cancelli; fr. the latticework enclosing it] : the part of a church containing the altar and seats for the clergy and choir
chan·cel·lery or chan·cel·lory \'chan(t)-s(ə-)lə-rē, -səl-rē\ n, pl -ler·ies or -lor·ies 1 a : the position, court, or department of a chancellor b : the building or room where a chancellor has his office 2 : the office of secretary of the court of a person high in authority 3 : the office or staff of an embassy or consulate
chan·cel·lor \'chan(t)-s(ə-)lər\ n [ME chanceler, fr. OF chancelier, fr. LL cancellarius doorkeeper, secretary, fr. cancellus] 1 a : the secretary of a nobleman, prince, or king b : the lord chancellor of Great Britain c Brit : the chief secretary of an embassy d : a Roman Catholic priest heading the office in which diocesan business is transacted and recorded 2 a : the titular head of a British university b (1) : a university president (2) : the chief executive officer in some state systems of higher education 3 a : a lay legal officer or adviser of an Anglican diocese b : a judge in a court of chancery or equity in various states of the U.S. 4 : the chief minister of state in some European countries — chan·cel·lor·ship \-,ship\ n
chancellor of the exchequer often cap C&E : a member of the British cabinet in charge of the public income and expenditure
chance-med·ley \'chan(t)-'smed-lē\ n [AF chance medlee mingled chance] 1 : accidental homicide not entirely without fault of the killer but without evil intent 2 : haphazard action : CONFUSION
chance music n : music in which the elements of chance are introduced by the composer (as by selecting tempo, pitch, or dynamics by the throw of dice) or by the performer (as by choosing what parts to perform and the manner and order in which they are performed)
chan·cery \'chan(t)s-(ə-)rē\ n, pl -cer·ies [ME chancerie, alter. of chancellerie chancellery, fr. OF, fr. chancelier] 1 a cap : a high court of equity in England and Wales with common-law functions and jurisdiction over causes in equity b : a court of equity in the American judicial system c : the principles and practice of judicial equity 2 : a record office for public archives or those of ecclesiastical, legal, or diplomatic proceedings 3 a : a chancellor's court or office or the building in which he has his office b : the office in which the business of a Roman Catholic diocese is transacted and recorded c : the office of an embassy : CHANCELLERY 3 — in chancery 1 : in litigation in a court of chancery; also : under the superintendence of the lord chancellor ⟨a ward in chancery⟩ 2 : in a hopeless predicament

ə abut ˈ kitten ər further a back ā bake ä cot, cart
aů out ch chin e less ē easy g gift i trip ī life
j joke ŋ sing ō flow ȯ flaw ȯi coin th thin th this
ü loot ů foot y yet yü few yů furious zh vision

lent ~⟩ 7 : the act of
·elease or dismissal esp.
e separation from mili·
ifference of electric po-
ersion of the chemical

:h discharge of electric-
f the enclosed vapor or
ısed gas is enhanced by

:ontains gas or vapor at
ıon takes place when a

having flowers with the

oval in shape
ıl & OF *desciple*, fr. LL
·ist in bis lifetime, fr. L,
spreading the doctrines
e inner circle of Christ's
ts b : a convinced ad-
member of the Disciples
holds the Bible alone to
ɔy immersion, and has a
WER — **dis·ci·ple·ship**

·lən-\ *adj* 1 : DOCILE,
cipline ⟨a ~ offense⟩
one who disciplines or

is-ə-ˈplin-ə-rē\ *adj* 1 a
.ed to correct or punish
: of or relating to a par-
\ˌdis·ə·plə-ˈner-ə-lē\ *adv*

& L; MF, fr. L *disciplina*
obs : INSTRUCTION 2 : a
3 : training that corrects,
or moral character 4
/ enforcing obedience or
or pattern of behavior c
ıles governing conduct or

ıunish or penalize for the
ɔ by instruction and exer-
; (a group) under control
the writer ~*s* and refines
i·plin·er *n*
g discipline ⟨a ~ mind⟩
ɔ or TV show of popular
mments not related to the

r. *dis-* + *claimer* to claim,
ıer 2 a *obs* : to disavow
vt 1 : to renounce a legal

ner, v.] 1 a : a denial or
nt of or formal refusal to
ing that embodies a legal
ı : REPUDIATION
ENUNCIATION, DISAVOWAL

vely stable ecological com-
sms foreign to the region
urbance esp. by man
fr. MF *desclos-*, stem of
to open, fr. L *dis-* + *clau-*
: : to open up 2 a : to
to make known or public
:ret) ⟨demands that politi-
yn see REVEAL — **dis·clos-**

:t or an instance of disclos-
l : REVELATION
EQUE

ıe that compiles discogra-

ıgraphie, fr. *disc-* + *-graphie*
ɔgraph records by category,
ıse 2 : the history of re-
ˌdis-kə-ˈgraf-i-kəl\ *also* **dis-**
i·cal·ly \-i-k(ə-)lē\ *adv*
quoit-shaped, fr. Gk *disko-*
ı disk or discus : being flat
a disk: as a *of a composite*
of a composite flower head

ıbling, or producing a disk:
: whorls form a flat coil b
ore disklike areas
ıuren, fr. MF *descolourer*, fr.
er color, fr. *dis-* + *color*] *vt*
of ~ *vi* : to change color

n 1 : the act of discoloring
discolored spot or formation

ıə-ˌlāt\ *vt* -**lat·ed**; -**lat·ing**
CONFUSE ⟨the offensive had
nsive arrangements —A. J.
ˌbäb-(y)ə-ˈlā-shən\ *n*

¹**dis·com·fit** \dis-ˈkəm(p)-fət, *esp South* ˌdis-kəm-ˈfit\ *vt* [ME *discomfiten*, fr. OF *desconfit*, pp. of *desconfire*, fr. *des-* + *confire* to prepare — more at COMFIT] 1 a *archaic* : to defeat in battle b : to frustrate the plans of : THWART 2 : to put into a state of perplexity and embarrassment : DISCONCERT **syn** see EMBARRASS

²**discomfit** *n* : DISCOMFITURE

dis·com·fi·ture \dis-ˈkəm(p)-fə-ˌchu̇(ə)r, -chər, -ˌt(y)u̇(ə)r\ *n* : the act of discomfiting : the state of being discomfited

¹**dis·com·fort** \dis-ˈkəm(p)-fərt\ *vt* [ME *discomforten*, fr. MF *desconforter*, fr. OF, fr. *des-* + *conforter* to comfort] 1 *archaic* : DISMAY 2 : to make uncomfortable or uneasy — **dis·com·fort·able** \-ˈkəm(p)-fərt-ə-bəl, -ˈkəm(p)(f)-tə(r)-bəl\ *adj* — **dis·com·fort·er** \-ˈkəm(p)-fərt-ər\ *n*

²**discomfort** *n* 1 *archaic* : DISTRESS, GRIEF 2 : mental or physical uneasiness : ANNOYANCE ⟨he gave every sign of intense ~⟩

dis·com·mend \ˌdis-kə-ˈmend\ *vt* 1 : DISAPPROVE, DISPARAGE 2 : to cause to be viewed unfavorably — **dis·com·mend·able** \-ˈmen-də-bəl\ *adj* — **dis·com·men·da·tion** \(ˌ)dis-ˌkäm-ən-ˈdā-shən, -ˌkäm-ˌen-\ *n*

dis·com·mode \ˌdis-kə-ˈmōd\ *vt* -**mod·ed**; -**mod·ing** [MF *discommoder*, fr. *dis-* + *commode* convenient — more at COMMODE] : to cause inconvenience to : TROUBLE

dis·com·pose \ˌdis-kəm-ˈpōz\ *vt* 1 : to destroy the composure or serenity of 2 : to disturb the order of — **dis·com·po·sure** \-ˈpō-zhər\ *n*

syn DISCOMPOSE, DISQUIET, DISTURB, PERTURB, AGITATE, UPSET, FLUSTER, FLURRY *shared meaning element* : to destroy or impair one's capacity for collected thought or decisive action **ant** compose

dis·con·cert \ˌdis-kən-ˈsərt\ *vt* [obs. F *disconcerter*, alter. of MF *desconcerter*, fr. *des-* + *concerter* to concert] 1 : to throw into confusion 2 : to disturb the composure of **syn** see EMBARRASS — **dis·con·cert·ing** *adj* — **dis·con·cert·ing·ly** \-iŋ-lē\ *adv*

dis·con·firm \ˌdis-kən-ˈfərm\ *vt* : to establish as invalid : DISPROVE

dis·con·form·able \ˌdis-kən-ˈfȯr-mə-bəl\ *adj* : of or relating to a disconformity in rocks — **dis·con·form·ably** \-blē\ *adv*

dis·con·for·mi·ty \ˌdis-kən-ˈfȯr-mət-ē\ *n* 1 *archaic* : NONCONFORMITY 2 : a break in a sequence of sedimentary rocks all of which have approximately the same dip

dis·con·nect \ˌdis-kə-ˈnekt\ *vt* : to sever the connection of or between ~ *vi* 1 : to terminate a connection 2 : to become detached or withdrawn ⟨he has periods when he ~*s* into silences —*Current Biog.*⟩

dis·con·nect·ed *adj* : not connected : INCOHERENT — **dis·con·nect·ed·ly** *adv* — **dis·con·nect·ed·ness** *n*

dis·con·so·late \dis-ˈkän(t)-s(ə-)lət\ *adj* [ME, fr. ML *disconsolatus*, fr. L *dis-* + *consolatus*, pp. of *consolari* to console] 1 : DEJECTED, DOWNCAST ⟨the team returned ~ from three losses⟩ 2 : CHEERLESS ⟨a clutch of ~ houses —D. H. Lawrence⟩ — **dis·con·so·late·ly** *adv* — **dis·con·so·late·ness** *n* — **dis·con·so·la·tion** \(ˌ)dis-ˌkän(t)-sə-ˈlā-shən\ *n*

¹**dis·con·tent** \ˌdis-kən-ˈtent\ *adj* : DISCONTENTED

²**discontent** *n* : one who is discontented : MALCONTENT

³**discontent** *vt* : to make discontented — **dis·con·tent·ment** \-mənt\ *n*

⁴**discontent** *n* : lack of contentment: a : a sense of grievance : DISSATISFACTION ⟨the winter of our ~ —Shak.⟩ b : restless aspiration for improvement

dis·con·tent·ed *adj* : DISSATISFIED, MALCONTENT — **dis·con·tent·ed·ly** *adv* — **dis·con·tent·ed·ness** *n*

dis·con·tin·u·ance \ˌdis-kən-ˈtin-yə-wən(t)s\ *n* 1 : the act or an instance of discontinuing 2 : the interruption or termination of a legal action by failure to continue or by the plaintiff's entry of a discontinuing order

dis·con·tin·ue \ˌdis-kən-ˈtin-(ˌ)yü, -yə(-w)\ *vb* [ME *discontinuen*, fr. MF *discontinuer*, fr. ML *discontinuare*, fr. L *dis-* + *continuare* to continue] *vt* 1 : to break the continuity of : cease to operate, administer, use, or take 2 : to abandon or terminate by a legal discontinuance ~ *vi* : to come to an end; *specif* : to cease publication **syn** see STOP **ant** continue

dis·con·ti·nu·ity \(ˌ)dis-ˌkänt-ˀn-ˈ(y)ü-ət-ē\ *n* 1 : lack of continuity or cohesion 2 : GAP 5 3 : a value of an argument at which a function is not continuous

dis·con·tin·u·ous \ˌdis-kən-ˈtin-yə-wəs\ *adj* 1 a (1) : not continuous ⟨a ~ series of events⟩ (2) : not continued : DISCRETE ⟨~ features of terrain⟩ b : lacking sequence or coherence ⟨this ~ style⟩ 2 : having one or more discontinuities — used of a variable or a function — **dis·con·tin·u·ous·ly** *adv*

dis·co·phile \ˈdis-kə-ˌfīl\ *n* : one who studies and collects phonograph records

¹**dis·cord** \ˈdis-ˌkȯ(ə)rd\ *n* 1 a : lack of agreement or harmony (as between persons, things, or ideas) b : active quarreling or conflict resulting from discord among persons or factions : STRIFE 2 a (1) : a combination of musical sounds that strike the ear harshly (2) : DISSONANCE b : a harsh or unpleasant sound

syn DISCORD, STRIFE, CONFLICT, CONTENTION, DISSENSION, DIFFERENCE, VARIANCE *shared meaning element* : the state of those who disagree and lack harmony or the acts and circumstances marking such a state

²**dis·cord** \ˈdis-ˌkȯ(ə)rd, dis-ˈ\ *vi* [ME *discorden*, fr. OF *discorder*, fr. L *discordare*, fr. *discord-*, *discors* discordant, fr. *dis-* + *cord-*, *cor* heart — more at HEART] : DISAGREE, CLASH

dis·cor·dance \dis-ˈkȯrd-ˀn(t)s\ *n* 1 : the state or an instance of being discordant 2 : DISSONANCE

dis·cor·dan·cy \-ˀn-sē\ *n*, *pl* -**cies** : DISCORDANCE

dis·cor·dant \-ˀnt\ *adj* 1 a : being at variance : DISAGREEING b : QUARRELSOME 2 : relating to a discord — **dis·cor·dant·ly** *adv*

dis·co·theque \ˈdis-kə-ˌtek, ˌdis-kə-ˈ\ *n* [F *discothèque*, fr. *disque* disk, record + *-o-* + *-thèque* (as in *bibliothèque* library)] : a small intimate nightclub for dancing to live or recorded music; *broadly* : a nightclub often featuring psychedelic and mixed-media attractions (as slides, movies, special lighting effects, and kinetic sound)

¹**dis·count** \ˈdis-ˌkau̇nt\ *n* 1 : a reduction made from the gross amount or value of something: as a (1) : a reduction made from a regular or list price (2) : a proportionate deduction from a debt account usu. made for cash or prompt payment b : a deduction made for interest in advancing money upon or purchasing a bill or note not due 2 : the act or practice of discounting 3 : a deduction taken or allowance made

²**dis·count** \ˈdis-ˌkau̇nt, dis-ˈ\ *vb* [modif. of F *décompter*, fr. OF *desconter*, fr. ML *discomputare*, fr. L *dis-* + *computare* to count — more at COUNT] *vt* 1 a : to make a deduction from usu. for cash or prompt payment b : to sell or offer for sale at a discount 2 : to lend money on after deducting the discount 3 a : to leave out of account : DISREGARD b : to underestimate the importance of : MINIMIZE c (1) : to make allowance for bias or exaggeration in (2) : to view with doubt : DISBELIEVE d : to take into account (as a future event) in present calculations ~ *vi* : to give or make discounts

dis·count·able \dis-ˈkau̇nt-ə-bəl, ˈdis-ˌ\ *adj* 1 : capable of being discounted ⟨a ~ note⟩ 2 : set apart for discounting ⟨within the ~ period⟩

¹**dis·coun·te·nance** \dis-ˈkau̇nt-ˀn-ən(t)s, -ˈkau̇nt-nən(t)s\ *vt* 1 : ABASH, DISCONCERT 2 : to look with disfavor on : discourage by evidence of disapproval

²**discountenance** *n* : DISFAVOR, DISAPPROVAL

dis·count·er \ˈdis-ˌkau̇nt-ər, dis-ˈ\ *n* : one that discounts; *specif* : DISCOUNT STORE

discount house *n* : DISCOUNT STORE

discount rate *n* 1 : the interest on an annual basis deducted in advance on a bank or other loan 2 : the charge levied by a central bank for advances and rediscounts

discount store *n* : a store where merchandise (as consumer durable goods) is sold at a discount from suggested list price

dis·cour·age \dis-ˈkər-ij, -ˈkə-rij\ *vt* -**aged**; -**ag·ing** [MF *descorager*, fr. OF *descoragier*, fr. *des-* dis- + *corage* courage] 1 : to deprive of courage or confidence : DISHEARTEN 2 a : to hinder by disfavoring : DETER b : to attempt to dissuade — **dis·cour·age·able** \-ə-bəl\ *adj* — **dis·cour·ag·er** *n*

dis·cour·age·ment \-mənt\ *n* 1 : the act of discouraging : the state of being discouraged 2 : something that discourages : DETERRENT

dis·cour·ag·ing *adj* : lessening courage : DISHEARTENING — **dis·cour·ag·ing·ly** \-ij-iŋ-lē\ *adv*

¹**dis·course** \ˈdis-ˌkō(ə)rs, -ˌkȯ(ə)rs, dis-ˈ\ *n* [ME *discours*, fr. ML & LL *discursus*; ML, argument, fr. LL, conversation, fr. L, act of running about, fr. *discursus*, pp. of *discurrere* to run about, fr. *dis-* + *currere* to run — more at CAR] 1 *archaic* : the capacity of orderly thought or procedure : RATIONALITY 2 : verbal interchange of ideas; *esp* : CONVERSATION 3 a : formal and orderly and usu. extended expression of thought on a subject b : connected speech or writing 4 *obs* : social familiarity

²**dis·course** \dis-ˈkō(ə)rs, -ˈkȯ(ə)rs, ˈdis-ˌ\ *vb* **dis·coursed**; **dis·cours·ing** *vi* 1 : to express oneself esp. in oral discourse 2 : TALK, CONVERSE ~ *vt*, *archaic* : to give forth : UTTER — **dis·cours·er** *n*

dis·cour·te·ous \(ˈ)dis-ˈkərt-ē-əs\ *adj* : lacking courtesy : RUDE — **dis·cour·te·ous·ly** *adv* — **dis·cour·te·ous·ness** *n*

dis·cour·te·sy \-ˈkərt-ə-sē\ *n* 1 : RUDENESS 2 : a rude act

dis·cov·er \dis-ˈkəv-ər\ *vb* **dis·cov·ered**; **dis·cov·er·ing** \-ˈkəv-(ə-)riŋ\ [ME *discoveren*, fr. OF *descovrir*, fr. LL *discooperire*, fr. L *dis-* + *cooperire* to cover — more at COVER] *vt* 1 a : to make known or visible : EXPOSE b *archaic* : DISPLAY 2 : to obtain sight or knowledge of for the first time : FIND ⟨~ the solution of a puzzle⟩ ~ *vi* : to make a discovery — **dis·cov·er·able** \-ˈkəv-(ə-)rə-bəl\ *adj* — **dis·cov·er·er** \-ər-ər\ *n*

syn 1 see REVEAL
2 DISCOVER, ASCERTAIN, DETERMINE, UNEARTH, LEARN *shared meaning element* : to find out something not previously known to one
3 see INVENT

dis·cov·ery \dis-ˈkəv-(ə-)rē\ *n*, *pl* -**er·ies** 1 a : the act or process of discovering b (1) *archaic* : DISCLOSURE (2) *obs* : DISPLAY c *obs* : EXPLORATION 2 : something discovered

Discovery Day *n* : COLUMBUS DAY

¹**dis·cred·it** \(ˈ)dis-ˈkred-ət\ *vt* 1 : to refuse to accept as true or accurate : DISBELIEVE 2 : to cause disbelief in the accuracy or authority of 3 : to deprive of good repute : DISGRACE

²**discredit** *n* 1 : loss of credit or reputation ⟨I knew stories to the ~ of England —W. B. Yeats⟩ 2 : lack or loss of belief or confidence : DOUBT ⟨contradictions cast ~ on his testimony⟩

dis·cred·it·able \-ə-bəl\ *adj* : injurious to reputation — **dis·cred·it·ably** \-blē\ *adv*

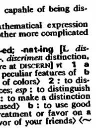
dis·creet \dis-ˈkrēt\ *adj* [ME, fr. MF *discret*, fr. ML *discretus*, fr. L, pp. of *discernere* to separate, distinguish between — more at DISCERN] 1 : having or showing discernment or good judgment in conduct and esp. in speech : PRUDENT, *esp* : capable of preserving prudent silence 2 : UNPRETENTIOUS, MODEST ⟨the warmth and ~ elegance of a civilized home —Joseph Wechsberg⟩ — **dis·creet·ly** *adv* — **dis·creet·ness** *n*

dis·crep·an·cy \dis-ˈkrep-ən-sē\ *n*, *pl* -**cies** 1 : the quality or state of being discrepant : DIFFERENCE 2 : an instance of being discrepant

dis·crep·ant \-ənt\ *adj* [L *discrepant-*, *discrepans*, prp. of *discrepare* to sound discordantly, fr. *dis-* + *crepare* to rattle, creak — more at RAVEN] : being at variance : DISAGREEING ⟨widely ~ conclusions⟩ — **dis·crep·ant·ly** *adv*

dis·crete \dis-ˈkrēt, ˈdis-ˌ\ *adj* [ME, fr. L *discretus*] 1 : constituting a separate entity : individually distinct 2 a : consisting of distinct or unconnected elements : NONCONTINUOUS b : taking on or having a finite or countably infinite number of values : not mathe-

matically continuous ⟨a ~ random variable⟩ *syn* see DISTINCT —
dis·crete·ly *adv* — **dis·crete·ness** *n*
dis·cre·tion \dis-ˈkresh-ən\ *n* **1 :** the quality of being discreet
: CIRCUMSPECTION; *esp* **:** cautious reserve in speech **2 :** ability to
make responsible decisions **3 a :** individual choice or judgment
⟨left the decision to his ~⟩ **b :** power of free decision or latitude
of choice within certain legal bounds ⟨reached the age of ~⟩ **4**
: the result of separating or distinguishing ⟨breaking down every
operation into discrete parts, and then making verbal the ~s that
are made —Elinor Langer⟩
dis·cre·tion·ary \-ˈkresh-ə-ˌner-ē\ *adj* **1 :** left to discretion **:** exer-
cised at one's own discretion **2 :** available for discretionary use
⟨~ purchasing power⟩
discretionary account *n* **:** a security or commodity market ac-
count in which an agent (as a broker) is given power of attorney
allowing him to make independent decisions and buy and sell for
the account of his principal
dis·crim·i·na·bil·i·ty \-ˌkrim-(ə-)nə-ˈbil-ət-ē\ *n, pl* **-ties** **1 :** the
quality of being discriminable ⟨the ~ of the various senses of a
word⟩ **2 :** the ability to discriminate
dis·crim·i·na·ble \dis-ˈkrim-(ə-)nə-bəl\ *adj* **:** capable of being dis-
criminated — **dis·crim·i·na·bly** \-blē\ *adv*
dis·crim·i·nant \-ˈkrim-(ə-)nənt\ *n* **:** a mathematical expression
providing a criterion for the behavior of another more complicated
expression, relation, or set of relations
dis·crim·i·nate \dis-ˈkrim-ə-ˌnāt\ *vb* **-nat·ed; -nat·ing** [L *dis-*
criminatus, pp. of *discriminare,* fr. *discrimin-, discrimen* distinction,
fr. *discernere* to distinguish between — more at DISCERN] *vt* **1 a**
: to mark or perceive the distinguishing or peculiar features of **b**
: DISTINGUISH, DIFFERENTIATE ⟨~ hundreds of colors⟩ **2 :** to dis-
tinguish by discerning or exposing differences; *esp* **:** to distinguish
(one like object) from another ~ *vi* **1 a :** to make a distinction
⟨~ among the methods which should be used⟩ **b :** to use good
judgment **2 :** to make a difference in treatment or favor on a
basis other than individual merit ⟨~ in favor of your friends⟩ ⟨~
against a certain nationality⟩
dis·crim·i·nat·ing *adj* **1 :** making a distinction **:** DISTINGUISHING
2 : marked by discrimination: **a :** DISCERNING, JUDICIOUS **b**
: DISCRIMINATORY — **dis·crim·i·nat·ing·ly** \-ˌnāt-iŋ-lē\ *adv*
dis·crim·i·na·tion \dis-ˌkrim-ə-ˈnā-shən\ *n* **1 a :** the act of dis-
criminating **b :** the process by which two stimuli differing in
some aspect are responded to differently **:** DIFFERENTIATION **2**
: the quality or power of finely distinguishing **3 a :** the act,
practice, or an instance of discriminating categorically rather than
individually **b :** prejudiced or prejudicial outlook, action, or
treatment ⟨provided major opportunities for Negro advancement
on purely equal terms involving neither ~ nor preference —D. P.
Moynihan⟩ *syn* see DISCERNMENT — **dis·crim·i·na·tion·al**
\-shnəl, -shən-ᵊl\ *adj*
dis·crim·i·na·tive \dis-ˈkrim-ə-ˌnāt-iv, ˈkrim-(ə-)nət-\ *adj* **1**
: making distinctions **2 :** DISCRIMINATORY 1 ⟨permitted tariffs
which were grossly ~ —Mabel R. Gillis⟩
dis·crim·i·na·tor \dis-ˈkrim-ə-ˌnāt-ər\ *n* **:** one that discriminates;
specif **:** a circuit that can be adjusted to accept or reject signals of
different characteristics (as amplitude or frequency)
dis·crim·i·na·to·ry \dis-ˈkrim-(ə-)nə-ˌtōr-ē, -ˌtȯr-\ *adj* **1 :** applying
or favoring discrimination in treatment **2 :** DISCRIMINATIVE 1 —
dis·crim·i·na·to·ri·ly \-ˌkrim-(ə-)nə-ˈtōr-ə-lē, -ˈtȯr-\ *adv*
dis·cur·sive \dis-ˈkər-siv\ *adj* [ML *discursivus,* fr. L *discursus,* pp. of
discurrere to run about — more at DISCOURSE] **1 :** passing from
one topic to another **:** DIGRESSIVE **2 :** marked by analytical rea-
soning — **dis·cur·sive·ly** *adv* — **dis·cur·sive·ness** *n*
dis·cus \ˈdis-kəs\ *n, pl* **dis·cus·es** [L —
more at DISH] **1 a :** a disk (as of
wood, rubber, or metal) that is thicker
in the center than at the perimeter and
that is hurled for distance **b :** a field
event in which a discus of about 4½
pounds is hurled **2 :** DISK 2, 3



1, discus 1a

dis·cuss \dis-ˈkəs\ *vt* [ME *discussen,* fr.
L *discussus,* pp. of *discutere,* fr. *dis-*
apart + *quatere* to shake — more at
DIS-, QUASH] **1** *obs* **:** DISPEL **2 a :** to
investigate by reasoning or argument
b : to present in detail for examination
or consideration ⟨~*ed* plans for the
party⟩ **c :** to talk about **3** *obs* **:** DE-
CLARE — **dis·cuss·able** *or* **dis·cuss·ible**
\-ə-bəl\ *adj* — **dis·cuss·er** *n*
syn DISCUSS, ARGUE, DEBATE, DISPUTE *shared meaning element* **:** to
discourse about something in order to arrive at the truth or to
convince others of the validity of one's position
dis·cus·sant \dis-ˈkəs-ᵊnt\ *n* **:** one who takes part in a formal dis-
cussion or symposium
dis·cus·sion \dis-ˈkəsh-ən\ *n* **1 :** consideration of a question in
open and usu. informal debate **2 :** a formal treatment of a topic
¹**dis·dain** \dis-ˈdān\ *n* [ME *desdeyne,* fr. OF *desdeign,* fr. *desdeig-*
nier]**:** a feeling of contempt for what is beneath one **:** SCORN
²**disdain** *vt* [ME *desdeynen,* fr. MF *desdeignier,* fr. (assumed) VL
disdignare, fr. L *dis-* + *dignare* to deign — more at DEIGN] **1 :** to
look with scorn on **2 :** to refuse or abstain from because of dis-
dain **3 :** to treat disdainfully *syn* see DESPISE *ant* favor
dis·dain·ful \-fəl\ *adj* **:** full of or expressing disdain *syn* see
PROUD — **dis·dain·ful·ly** \-fə-lē\ *adv* — **dis·dain·ful·ness** *n*
dis·ease \diz-ˈēz\ *n* [ME *disese,* fr. MF *desaise,* fr. *des-* dis- + *aise*
ease] **1** *obs* **:** TROUBLE **2 :** a condition of the living animal or
plant body or of one of its parts that impairs the performance of a
vital function **:** SICKNESS, MALADY **3 :** a harmful development (as
in a social institution) ⟨the various ~*s* of civilization⟩ — **dis·eased**
\-ˈēzd\ *adj*
dis·econ·o·my \ˌdis-i-ˈkän-ə-mē\ *n* **1 :** a lack of economy **2 :** a
factor responsible for an increase in cost
dis·em·bark \ˌdis-əm-ˈbärk\ *vb* [MF *desembarquer,* fr. *des-* + *em-*
barquer to embark] *vt* **:** to put ashore from a ship ~ *vi* **1 :** to go
ashore out of a ship **2 :** to get out of a vehicle — **dis·em·bar·ka-**
tion \(ˌ)dis-ˌem-ˌbär-ˈkā-shən, -bər-\ *n*
dis·em·bar·rass \ˌdis-əm-ˈbar-əs\ *vt* **:** to free from something trou-
blesome or superfluous *syn* see EXTRICATE
dis·em·body \ˌdis-əm-ˈbäd-ē\ *vt* **:** to divest of a body, of corporeal
existence, or of reality
dis·em·bogue \ˌdis-əm-ˈbōg\ *vb* **-bogued; -bogu·ing** [modif. of Sp
desembocar, fr. *des-* dis- (fr. L *dis-*) + *embocar* to put into the
mouth, fr. *en* in (fr. L *in*) + *boca* mouth, fr. L *bucca* — more at
POCK] *vi* **:** to flow or come forth from or as if from a channel ~ *vt*
: to pour out **:** EMPTY
dis·em·bow·el \ˌdis-əm-ˈbau̇(-ə)l\ *vt* **1 :** to take out the bowels of
: EVISCERATE **2 :** to remove the substance of — **dis·em·bow·el-**
ment \-mənt\ *n*
dis·en·chant \ˌdis-ᵊn-ˈchant\ *vt* [MF *desenchanter,* fr. *des-* + *en-*
chanter to enchant]**:** to free from illusion — **dis·en·chant·er** *n* —
dis·en·chant·ing *adj* — **dis·en·chant·ing·ly** \-iŋ-lē\ *adv* — **dis-**
en·chant·ment \-mənt\ *n*
dis·en·cum·ber \ˌdis-ᵊn-ˈkəm-bər\ *vt* [MF *desencombrer,* fr. *des-* +
encombrer to encumber]**:** to free from encumbrance **:** DISBURDEN
syn see EXTRICATE
dis·en·dow \ˌdis-ᵊn-ˈdau̇\ *vt* **:** to strip of endowment — **dis·en-**
dow·er \-ˈdau̇(-ə)r\ *n* — **dis·en·dow·ment** \-ˈdau̇-mənt\ *n*
dis·en·fran·chise \ˌdis-ᵊn-ˈfran-ˌchīz\ *vt* **:** DISFRANCHISE — **dis·en-**
fran·chise·ment \-ˌchīz-mənt, -chəz-\ *n*
dis·en·gage \ˌdis-ᵊn-ˈgāj\ *vb* [F *désengager,* fr. MF, fr. *des-* + *en-*
gager to engage] *vt* **:** to release from something that engages ~ *vi*
: to release or detach oneself **:** WITHDRAW — **dis·en·gage·ment**
\-mənt\ *n*
dis·en·tail \ˌdis-ᵊn-ˈtā(ə)l\ *vt* **:** to free from entail
dis·en·tan·gle \ˌdis-ᵊn-ˈtaŋ-gəl\ *vt* **:** to free from entanglement **:** UN-
RAVEL ~ *vi* **:** to become disentangled *syn* see EXTRICATE *ant*
entangle — **dis·en·tan·gle·ment** \-mənt\ *n*
dis·en·thrall *also* **dis·en·thral** \ˌdis-ᵊn-ˈthrȯl\ *vt* **:** to free from
bondage **:** LIBERATE
dis·equil·i·brate \ˌdis-i-ˈkwil-ə-ˌbrāt\ *vt* **:** to put out of balance —
dis·equil·i·bra·tion \-ˌkwil-ə-ˈbrā-shən\ *n*
dis·equi·lib·ri·um \(ˌ)dis-ˌē-kwə-ˈlib-rē-əm, -ˌek-wə-\ *n* **:** loss or
lack of equilibrium
dis·es·tab·lish \ˌdis-ə-ˈstab-lish\ *vt* **:** to deprive of an established
status; *esp* **:** to deprive of the status and privileges of an established
church — **dis·es·tab·lish·ment** \-mənt\ *n*
dis·es·tab·lish·men·tar·i·an \-ˌstab-lish-ˌmen-ˈter-ē-ən, -mən-\ *n,*
often cap [*disestablishment*]**:** one who opposes an established order
— **disestablishmentarian** *adj, often cap*
¹**dis·es·teem** \ˌdis-ə-ˈstēm\ *vt* **:** to regard with disfavor
²**disesteem** *n* **:** DISFAVOR, DISREPUTE
di·seuse \dē-ˈzə(r)z, -ˈzüz\ *n, pl* **di·seuses** \-ˈzə(r)z(-əz), -ˈzüz(-əz)\
[F, fem. of *diseur,* fr. OF, fr. *dire* to say, fr. L *dicere* — more at
DICTION]**:** a skilled and usu. professional woman reciter
¹**dis·fa·vor** \(ˈ)dis-ˈfā-vər\ *n* [prob. fr. MF *desfaveur,* fr. *des-* dis- +
faveur favor, fr. OF *favor*] **1 :** DISAPPROVAL, DISLIKE ⟨practices
looked upon with ~⟩ **2 :** the state or fact of being deprived of
favor ⟨fell into ~⟩ **3 :** DISADVANTAGE
²**disfavor** *vt* **:** to withhold or withdraw favor from
dis·fea·ture \(ˈ)dis-ˈfē-chər\ *vt* **:** to mar the features of *syn* see
DEFACE — **dis·fea·ture·ment** \-mənt\ *n*
dis·fig·ure \dis-ˈfig-yər, *esp Brit* -ˈfig-ər\ *vt* [ME *disfiguren,* fr. MF
desfigurer, fr. *des-* + *figure*] **1 :** to impair (as in beauty) by deep
and persistent injuries ⟨a girl *disfigured* by smallpox⟩ **2** *obs* **:** DIS-
GUISE *syn* see DEFACE — **dis·fig·ure·ment** \-mənt\ *n*
dis·fran·chise \(ˈ)dis-ˈfran-ˌchīz\ *vt* **:** to deprive of a franchise, of a
legal right, or of some privilege or immunity; *esp* **:** to deprive of the
right to vote — **dis·fran·chise·ment** \-ˌchīz-mənt, -chəz-\ *n*
dis·frock \(ˈ)dis-ˈfräk\ *vt* **:** UNFROCK
dis·func·tion *var of* DYSFUNCTION
dis·fur·nish \(ˈ)dis-ˈfər-nish\ *vt* [MF *desfourniss-,* stem of *desfour-*
nir, fr. *des-* + *fournir* to furnish — more at FURNISH] **:** to make
destitute of possessions **:** DIVEST — **dis·fur·nish·ment** \-mənt\ *n*
dis·gorge \(ˈ)dis-ˈgȯ(ə)rj\ *vb* [MF *desgorger,* fr. *des-* + *gorge*] *vt* **1**
a : to discharge by the throat and mouth **:** VOMIT **b :** to dis[charge]
violently, confusedly, or as a result of force **c :** to give up on re-
quest or under pressure ⟨refused to ~ his ill-gotten gains⟩ **2 :**
discharge the contents of (as the stomach) ~ *vi* **:** to disc[harge]
contents ⟨where the river ~*s* into the sea⟩
¹**dis·grace** \dis-ˈgrās\ *vt* **1** *archaic* **:** to humiliate by a su[perior]
showing **2 :** to bring reproach or shame to ⟨*disgraced* his f[amily]⟩
3 : to cause to lose favor or standing ⟨was *disgraced* by the [...]
scandal⟩ — **dis·grac·er** *n*
²**disgrace** *n* [MF, fr. OIt *disgrazia,* fr. *dis-* (fr. L) + *grazia* [grace, fr.]
L *gratia* — more at GRACE] **1 a :** loss of grace, favor, or [honor]
b : the condition of one fallen from grace or honor **2 :** [...]
that disgraces ⟨that boy's manners are a ~⟩
syn DISGRACE, DISHONOR, DISREPUTE, SHAME, INFAMY, IG[NOMINY],
OPPROBRIUM *shared meaning element* **:** loss of esteem and [...]
repute and the resulting denigration and contempt *ant* [...]
esteem
dis·grace·ful \dis-ˈgrās-fəl\ *adj* **:** bringing or involving [disgrace]
— **dis·grace·ful·ly** \-fə-lē\ *adv* — **dis·grace·ful·ness** *n*
dis·grun·tle \dis-ˈgrənt-ᵊl\ *vt* **dis·grun·tled; dis·grun[·tling]**
\-ˈgrənt-liŋ, -ᵊl-iŋ\ [*dis-* + *gruntle* (to grumble), fr. ME [...]
freq. of *grunten* to grunt] **:** to make ill-humored or [...]
⟨the workers are *disgruntled* with their wages⟩ — **dis[·grun·tle-]**
ment \-ᵊl-mənt\ *n*
¹**dis·guise** \dis-ˈgīz\ *vt* **dis·guised; dis·guis·ing** [ME [...]
MF *desguiser,* fr. OF, fr. *des-* + *guise*] **1 a :** to chan[ge the cus-]
tomary dress or appearance of **b :** to furnish with a f[alse appear-]
ance or an assumed identity **2** *obs* **:** DISFIGURE **3 :** to [obscure the]
existence or true state or character of **:** CONCEAL — **d[...]**
\-ˈgīz(-ə)d-lē\ *adv* — **dis·guise·ment** \-ˈgīz-mənt\ *n* — [...]
er *n*
syn DISGUISE, CLOAK, MASK, DISSEMBLE *shared meaning* [...]
alter so as to hide the true appearance, identity, inten[tion ...]
ing, or feelings

reciprocating piece driven by or against fluid pressure; *esp* : PISTON **d** (2) : a piece with a motion more or less like that of a ram or piston **e** : a rubber suction cup on a handle used to free plumbing traps and waste outlets of obstructions

plunging fire *n* : direct fire from a superior elevation resulting in the projectiles striking the target at a high angle

plunk \ˈpləŋk\ *vb* [imit.] *vt* **1** : to pluck or hit so as to produce a quick, hollow, metallic, or harsh sound **2** : to set down suddenly : PLUMP ~ *vi* **1** : to make a plunking sound **2** : to drop abruptly : DIVE **3** : to come out in favor of someone or something — used with *for* — **plunk** *n* — **plunk·er** *n*

plunk down *vi* : to drop abruptly : settle into position ~ *vt* **1 a** : to put down usu. firmly or abruptly ⟨*plunked* his money *down* on the counter⟩ **b** : to settle (*oneself*) into position ⟨*plunked* himself *down* on the bench⟩ **2** : to pay out

plu·per·fect \(ˈ)plü-ˈpər-fikt\ *adj* [modif. of LL *plusquamperfectus*, lit., more than perfect] : past perfect — **pluperfect** *n*

plu·ral \ˈplu̇r-əl\ *adj* [ME, fr. MF & L; MF *plurel*, fr. L *pluralis*, fr. *plur-, plus* more — more at PLUS] **1** : of, relating to, or constituting a class of grammatical forms usu. used to denote more than one or in some languages more than two ⟨*genetics* is ~ in form but takes a singular verb⟩ **2** : relating to or consisting of or containing more than one or more than one kind or class ⟨a ~ society⟩ — **plural** *n* — **plu·ral·ly** \-ə-lē\ *adv*

plu·ral·ism \ˈplu̇r-ə-ˌliz-əm\ *n* **1** : the quality or state of being plural **2** : the holding of two or more offices or positions (as benefices) at the same time **3 a** : a theory that there are more than one or more than two kinds of ultimate reality **b** : a theory that reality is composed of a plurality of entities **4 a** : a state of society in which members of diverse ethnic, racial, religious, or social groups maintain an autonomous participation in and development of their traditional culture or special interest within the confines of a common civilization **b** : a concept, doctrine, or policy advocating this state — **plu·ral·ist** \-ləst\ *adj or n* — **plu·ral·is·tic** \ˌplu̇r-ə-ˈlis-tik\ *adj* — **plu·ral·is·ti·cal·ly** \-ti-k(ə-)lē\ *adv*

plu·ral·i·ty \plu̇-ˈral-ət-ē\ *n, pl* **-ties** **1 a** : the state of being plural **b** : the state of being numerous **c** : a large number or quantity : MULTITUDE **2** : PLURALISM 2; *also* : a benefice held by plurism **3 a** : a number greater than another **b** : an excess of votes over those cast for an opposing candidate **c** : a number of votes cast for a candidate in a contest of more than two candidates that is greater than the number cast for any other candidate but not more than half the total votes cast

plu·ral·ize \ˈplu̇r-ə-ˌlīz\ *vt* **-ized; -iz·ing** : to make plural or express in the plural form — **plu·ral·iza·tion** \ˌplu̇r-ə-lə-ˈzā-shən\ *n*

pluri- *comb form* [L, fr. *plur-, plus*] : having or being more than one : MULTI- ⟨*pluri*axial⟩

plu·ri·ax·i·al \ˌplu̇r-ē-ˈak-sē-əl\ *adj* : having more than one axis; *specif* : having flowers developed on secondary shoots

plu·rip·o·tent \plü-ˈrip-ət-ənt\ *adj* : not fixed as to developmental potentialities : having developmental plasticity

[1]**plus** \ˈpləs\ *prep* [L, adv., more, fr. neut. of *plur-, plus*, adj., more; akin to Gk *pleiōn* more, L *plenus* full — more at FULL] : increased by : with the addition of ⟨four ~ five⟩ ⟨the debt ~ interest⟩

[2]**plus** *n, pl* **plus·es** \ˈpləs-əz\ *also* **plus·ses** **1** : PLUS SIGN **2** : an added quantity **3** : a positive factor or quality **4** : SURPLUS

[3]**plus** *adj* **1** : algebraically positive **2** : having, receiving, or being in addition to what is anticipated **3 a** : falling high in a specified range ⟨a grade of C ~⟩ **b** : greater than that specified **c** : possessing a specified quality to a high degree **4** : electrically positive **5** : relating to or being a particular one of the two mating types that are required for successful fertilization in sexual reproduction in some lower plants (as a fungus)

plus fours *n pl* : loose sports knickers made four inches longer than ordinary knickers

[1]**plush** \ˈpləsh\ *n* [MF *peluche*] : a fabric with an even pile longer and less dense than velvet pile

[2]**plush** *adj* **1** : relating to, resembling, or made of plush **2** : notably luxurious — **plush·ly** *adv* — **plush·ness** *n*

plushy \ˈpləsh-ē\ *adj* **plush·i·er; -est** **1** : having the texture of or covered with plush **2** : LUXURIOUS, SHOWY — **plush·i·ness** *n*

plus·sage \ˈpləs-ij\ *n* : amount over and above another

plus sign *n* : a sign + denoting addition or a positive quantity

Plu·to \ˈplüt-(ˌ)ō\ *n* [L *Pluton-, Pluto*, fr. Gk *Ploutōn*] **1** : the Greek god of the underworld — compare DIS **2** [NL] : the planet farthest from the sun — see PLANET table

plu·toc·ra·cy \plü-ˈtäk-rə-sē\ *n, pl* **-cies** [Gk *ploutokratia*, fr. *ploutos* wealth] **1** : government by the wealthy **2** : a controlling class of rich men — **plu·to·crat** \ˈplüt-ə-ˌkrat\ *n* — **plu·to·crat·ic** \ˌplüt-ə-ˈkrat-ik\ *adj* — **plu·to·crat·i·cal·ly** \-i-k(ə-)lē\ *adv*

plu·ton \ˈplü-ˌtän\ *n* [prob. back-formation fr. *plutonic*] : a typically large body of intrusive igneous rock

plu·to·ni·an \plü-ˈtō-nē-ən\ *adj, often cap* : of, relating to, or characteristic of Pluto or the lower world : INFERNAL

plu·ton·ic \plü-ˈtän-ik\ *adj* [L *Pluton-, Pluto*] **1** : formed by solidification of a molten magma deep within the earth and crystalline throughout ⟨~ rock⟩ **2** *often cap* : PLUTONIAN

plu·to·ni·um \plü-ˈtō-nē-əm\ *n* [NL, fr. *Pluton-, Pluto*, the planet Pluto] : a radioactive metallic element similar chemically to uranium that is formed as the isotope 239 by decay of neptunium and found in minute quantities in pitchblende, that undergoes slow disintegration with the emission of a helium nucleus to form uranium 235, and that is fissionable with slow neutrons to yield atomic energy — see ELEMENT table

[1]**plu·vi·al** \ˈplü-vē-əl\ *adj* [L *pluvialis*, fr. *pluvia* rain, fr. fem. of *pluvius* rainy, fr. *pluere* to rain — more at FLOW] **1 a** : of or relating to rain **b** : characterized by abundant rain **2** *of a geologic change* : resulting from the action of rain

[2]**pluvial** *n* : a prolonged period of wet climate ⟨the ~*s* of the early Pleistocene⟩

[1]**ply** \ˈplī\ *vt* **plied; ply·ing** [ME *plien* to fold, fr. MF *plier*, fr. L *plicare*; akin to OHG *flehtan* to braid, L *plectere*, Gk *plekein*] : to twist together ⟨~ two single yarns⟩

[2]**ply** *n, pl* **plies** **1 a** : one of the strands in a yarn **b** : one of several layers (as of cloth) usu. sewn or laminated together **c** : one of the veneer sheets forming plywood **d** : a layer of a paper or paperboard **2** : INCLINATION, BIAS

[3]**ply** *vb* **plied; ply·ing** [ME *plien*, short for *applien* to apply] *vt* **1 a** : to use or wield diligently ⟨busily ~*ing* his pen⟩ **b** : to practice or perform diligently ⟨~*ing* his trade⟩ **2** : to keep furnishing or supplying something to ⟨*plied* her with liquor⟩ **3** : to make a practice of rowing or sailing over or on ⟨the boat *plies* the river⟩ ~ *vi* **1** : to apply oneself steadily **2** : to go or travel regularly ⟨a steamer ~*ing* between opposite shores of the lake⟩

Plym·outh Rock \ˌplim-əth-\ *n* [fr. *Plymouth Rock*, on which the Pilgrims are supposed to have landed in 1620] : any of an American breed of medium-sized single-combed dual-purpose domestic fowls

ply·wood \ˈplī-ˌwu̇d\ *n* : a structural material consisting of sheets of wood glued or cemented together with the grains of adjacent layers arranged at right angles or at a wide angle

pm *abbr* **1** phase modulation **2** premium

Pm *symbol* promethium

PM *abbr* **1** paymaster **2** permanent magnet **3** police magistrate **4** postmaster **5** post meridiem **6** postmortem **7** prime minister **8** provost marshal

PMH *abbr* production per man-hour

pmk *abbr* postmark

PMLA *abbr* Publications of the Modern Language Association of America

pmt *abbr* payment

PN *abbr* promissory note

-pnea *or* **-pnoea** \(p)-nē-ə\ *n comb form* [NL, fr. Gk *-pnoia*, fr. *pnoia*, fr. *pnein* to breathe] : breath : breathing ⟨hyper*pnea*⟩ ⟨a*pnoea*⟩

pneum- *or* **pneumo-** *comb form* [NL, partly fr. Gk *pneum-*, (fr. *pneuma*), partly fr. Gk *pneumōn* lung] **1** : air : gas ⟨*pneumo*thorax⟩ **2** : lung ⟨*pneum*ectomy⟩ : pulmonary and ⟨*pneumo*gastric⟩ **3** : respiration ⟨*pneumo*graph⟩ **4** : pneumonia ⟨*pneumo*coccus⟩

pneu·ma \ˈn(y)ü-mə\ *n* [Gk] : SOUL, SPIRIT

pneumat- *or* **pneumato-** *comb form* [Gk, fr. *pneumat-, pneuma*] **1** : air : vapor : gas ⟨*pneumat*ics⟩ **2** : respiration ⟨*pneumato*meter⟩

pneu·mat·ic \n(y)u̇-ˈmat-ik\ *adj* [L *pneumaticus*, fr. Gk *pneumatikos*, fr. *pneumat-, pneuma* air, breath, spirit, fr. *pnein* to breathe — more at SNEEZE] **1** : of, relating to, or using gas (as air or wind): **a** : moved or worked by air pressure **b** (1) : adapted for holding or inflated with compressed air (2) : having air-filled cavities **2** : of or relating to the pneuma : SPIRITUAL — **pneu·mat·i·cal·ly** \-i-k(ə-)lē\ *adv*

pneu·ma·tic·i·ty \ˌn(y)ü-mə-ˈtis-ət-ē\ *n* : a condition marked by the presence of air cavities ⟨~ of bird bones⟩

pneu·mat·ics \n(y)u̇-ˈmat-iks\ *n pl but sing in constr* : a branch of mechanics that deals with the mechanical properties of gases

pneu·ma·tol·o·gy \ˌn(y)ü-mə-ˈtäl-ə-jē\ *n* [NL *pneumatologia*, fr. Gk *pneumat-, pneuma* + NL *-logia* -logy] : the study of spiritual beings or phenomena

pneu·ma·tol·y·sis \-ˈtäl-ə-səs\ *n* [NL] : the process by which pneumatolytic minerals are formed

pneu·ma·to·lyt·ic \ˌn(y)ü-mət-ᵊl-ˈit-ik, (ˌ)n(y)ü-ˌmat-ᵊl-\ *adj* [ISV] : formed or forming by hot vapors or superheated liquids under pressure — used esp. of minerals and ores

pneu·ma·tom·e·ter \ˌn(y)ü-mə-ˈtäm-ət-ər\ *n* **1** : an instrument for measuring the amount of force exerted by the lungs in respiration **2** : SPIROMETER

pneu·mato·phore \n(y)u̇-ˈmat-ə-ˌfō(ə)r, -ˌfȯ(ə)r\ *n* [ISV] **1** : a muscular gas-containing sac that serves as a float on a siphonophore colony **2** : a root often functioning as a respiratory organ in a marsh plant — **pneu·mato·phor·ic** \n(y)u̇-ˌmat-ə-ˈfȯr-ik, -ˈfär-\ *adj*

pneu·mec·to·my \n(y)u̇-ˈmek-tə-mē\ *n, pl* **-mies** [ISV] : the surgical removal of lung tissue

pneu·mo·ba·cil·lus \ˌn(y)ü-mō-bə-ˈsil-əs\ *n, pl* **-cil·li** \-ˌī *also* -ē\ [NL] : a bacterium (*Klebsiella pneumoniae*) associated with inflammations (as pneumonia) of the respiratory tract

pneu·mo·coc·cus \ˌn(y)ü-mə-ˈkäk-əs\ *n, pl* **-coc·ci** \-ˈkäk-(s)ī, -ˈkäk-(ˌ)(s)ē\ [NL] : a bacterium (*Diplococcus pneumoniae*) that causes an acute pneumonia involving one or more lobes of the lung — **pneu·mo·coc·cal** \-ˈkäk-əl\ *also* **pneu·mo·coc·cic** \-ˈkäk-(ˌ)sik\ *adj*

pneu·mo·co·ni·o·sis \ˈn(y)ü-mō-ˌkō-nē-ˈō-səs\ *n, pl* **-o·ses** \-ˌsēz\ [NL, fr. *pneum-* + Gk *konis* dust — more at INCINERATE] : a disease of the lungs caused by the habitual inhalation of irritant mineral or metallic particles — compare BLACK LUNG, SILICOSIS

pneu·mo·gas·tric \ˌn(y)ü-mə-ˈgas-trik\ *adj* **1** : of or relating to the lungs and the stomach **2** : VAGAL

pneu·mo·graph \ˈn(y)ü-mə-ˌgraf\ *n* [ISV] : an instrument for recording the thoracic movements or volume change during respiration

pneu·mo·nec·to·my \ˌn(y)ü-mə-ˈnek-tə-mē\ *n, pl* **-mies** [Gk *pneumōn* + ISV *-ectomy*] : excision of an entire lung or of one or more lobes of a lung

pneu·mo·nia \n(y)u̇-ˈmō-nyə\ *n* [NL, fr. Gk, fr. *pneumōn* lung, alter. of *pleumōn* — more at PULMONARY] : a disease of the lungs characterized by inflammation and consolidation followed by resolution and caused by infection or irritants

pneu·mon·ic \n(y)u̇-ˈmän-ik\ *adj* [NL *pneumonicus*, fr. Gk *pneumonikos*, fr. *pneumōn*] **1** : of or relating to the lungs : PULMONIC **2** : of, relating to, or affected with pneumonia

pneu·mo·no·ul·tra·mi·cro·scop·ic·sil·i·co·vol·ca·no·co·ni·o·sis \ˈn(y)ü-mə-(ˌ)nō-ˌəl-trə-ˌmī-krə-ˈskäp-ik-ˈsil-i-(ˌ)kō-(ˌ)väl-ˈkā-nō-ˌkō-nē-ˈō-səs\ *n* [NL, fr. Gk *pneumōn* + ISV *ultramicroscopic* + NL *silicon* + ISV *volcano* + Gk *konis* dust] : a pneumoconiosis caused by the inhalation of very fine silicate or quartz dust

pneu·mo·tho·rax \ˌn(y)ü-mə-ˈthō(ə)r-ˌaks, -ˈthȯ(ə)r-\ *n* [NL] : a state in which air or other gas is present in the pleural cavity and which occurs spontaneously as a result of disease or injury of lung

se·quined *or* **se·quinned** \-kwənd\ *adj* : ornamented with or as if with sequins

se·qui·tur \'sek-wət-ər, -wə-,tů(ə)r\ *n* [L, it follows, 3d pers. sing. pres. indic. of *sequi* to follow — more at SUE] : the conclusion of an inference : CONSEQUENCE

se·quoia \si-'kwȯi-(y)ə\ *n* [NL, genus name, fr. *Sequoya* (George Guess) †1843 Am Indian scholar] : either of two huge coniferous California trees of the pine family that reach a height of over 300 feet: **a** : BIG TREE **b** : REDWOOD 3a

ser *abbr* **1** serial **2** series **3** service

sera *pl of* SERUM

se·rac \sə-'rak, sā-\ *n* [F *sérac*, lit., a kind of white cheese, fr. ML *seracium* whey, fr. L *serum* whey — more at SERUM] : a pinnacle, sharp ridge, or block of ice among the crevasses of a glacier

se·ra·glio \sə-'ral-(,)yō, -'räl-\ *n, pl* **-glios** [It *serraglio* enclosure, seraglio, partly fr. ML *serraculum* bar of a door, bolt, fr. LL *serare* to bolt; partly fr. Turk *saray* palace — more at SEAR] **1** : HAREM 1a **2** : a palace of a sultan

se·rai \sə-'rī\ *n* [Turk & Per; Turk *saray* mansion, palace, fr. Per *sarāī* mansion, inn] **1** : CARAVANSARY **2** : SERAGLIO 2

ser·al \'sir-əl\ *adj* : of, relating to, or constituting an ecological sere

se·ra·pe \sə-'räp-ē, -'rap-\ *n* [MexSp *sarape*] : a colorful woolen shawl worn over the shoulders esp. by Mexican men

ser·aph \'ser-əf\ *also* **ser·a·phim** \-ə-,fim\ *n, pl* **seraphim** *or* **ser·aphs** [LL *seraphim*, pl., seraphs, fr. Heb *sĕrāphīm*] **1** : one of the 6-winged angels standing in the presence of God **2** *pl* : an order of angels — see CELESTIAL HIERARCHY — **se·raph·ic** \sə-'raf-ik\ *adj* — **se·raph·i·cal·ly** \-i-k(ə-)lē\ *adv*

Se·ra·pis \sə-'rā-pəs\ *n* [L, fr. Gk *Sarapis*] : an Egyptian god combining attributes of Osiris and Apis and having a widespread cult throughout Greece and Rome

[1]**Serb** \'sərb\ *n* [Serb *Srb*] **1** : a native or inhabitant of Serbia **2** : SERBIAN 2 — **Serb** *adj*

[2]**Serb** *abbr* Serbian

Ser·bi·an \'sər-bē-ən\ *n* **1** : SERB 1 **2 a** : the Serbo-Croatian language as spoken in Serbia **b** : a literary form of Serbo-Croatian using the Cyrillic alphabet — **Serbian** *adj*

Ser·bo–Cro·atian \,sər-(,)bō-krō-'ā-shən\ *n* **1** : the Slavic language of the Serbs and Croats consisting of Serbian written in the Cyrillic alphabet and Croatian written in the Roman alphabet **2** : one whose native language is Serbo-Croatian — **Serbo-Croatian** *adj*

[1]**sere** \'si(ə)r\ *adj* [ME, fr. OE *sēar* dry; akin to OHG *sōrēn* to wither, Gk *hauos* dry] **1** : WITHERED **2** *archaic* : THREADBARE

[2]**sere** *n* [L *series* series] : a series of ecological communities that succeed one another in the biotic development of an area or formation

[1]**ser·e·nade** \,ser-ə-'nād\ *n* [F *sérénade*, fr. It *serenata*, fr. *sereno* clear, calm (of weather), fr. L *serenus*] **1 a** : a complimentary vocal or instrumental performance; *esp* : one given outdoors at night for a woman **b** : a work so performed **2** : an instrumental composition in several movements, written for a small ensemble, and midway between the suite and the symphony in style

[2]**serenade** *vb* **-nad·ed; -nad·ing** *vt* : to perform a serenade in honor of ~ *vi* : to play a serenade — **ser·e·nad·er** *n*

ser·e·na·ta \,ser-ə-'nät-ə\ *n* [It, serenade] : an 18th century secular cantata of a dramatic character usu. composed in honor of an individual or event

ser·en·dip·i·tous \,ser-ən-'dip-ət-əs\ *adj* : obtained or characterized by serendipity ⟨~ discoveries⟩ — **ser·en·dip·i·tous·ly** *adv*

ser·en·dip·i·ty \-'dip-ət-ē\ *n* [fr. its possession by the heroes of the Per fairy tale *The Three Princes of Serendip*] : the faculty of finding valuable or agreeable things not sought for

[1]**se·rene** \sə-'rēn\ *adj* [L *serenus*; akin to OHG *serawēn* to become dry, Gk *xēros* dry] **1 a** : clear and free of storms or unpleasant change ⟨~ skies⟩ **b** : shining bright and steady ⟨the moon, ~ in glory —Alexander Pope⟩ **2** : marked by or suggestive of utter calm and unruffled repose or quietude ⟨a ~ smile⟩ **3** : AUGUST — used as part of a title ⟨His *Serene* Highness⟩ *syn* see CALM — **se·rene·ly** *adv* — **se·rene·ness** \-'rēn-nəs\ *n*

[2]**serene** *n* **1** : a serene condition or expanse (as of sky, sea, or light) **2** : SERENITY, TRANQUILLITY

se·ren·i·ty \sə-'ren-ət-ē\ *n* : the quality or state of being serene

serf \'sərf\ *n* [F, fr. L *servus* slave, servant, serf — more at SERVE] : a member of a servile feudal class bound to the soil and subject to the will of his lord — **serf·age** \'sər-fij\ *n* — **serf·dom** \'sərf-dəm, -təm\ *n*

serg *or* **sergt** *abbr* sergeant

serge \'sərj\ *n* [ME *sarge*, fr. MF, fr. (assumed) VL *sarica*, fr. L *serica*, fem. of *sericus* silken — more at SERICEOUS] : a durable twilled fabric having a smooth clear face and a pronounced diagonal rib on the front and the back

ser·gean·cy \'sär-jən-sē\ *n* : the function, office, or rank of a sergeant

ser·geant \'sär-jənt\ *n* [ME, servant, attendant, sergeant, fr. OF *sergent, serjant*, fr. L *servient-, serviens*, prp. of *servire* to serve] **1** : SERGEANT AT ARMS **2** *obs* : an officer who enforces the judgments of a court or the commands of one in authority **3** : an officer in a police force ranking in the U.S. just below captain or sometimes lieutenant and in England just below inspector **4** : a noncommissioned officer ranking in the army and marine corps above a corporal and below a staff sergeant and in the air force above an airman first class and below a staff sergeant; *broadly* : NONCOMMISSIONED OFFICER

sergeant at arms : an officer of an organization (as a legislative body or court of law) who preserves order and executes commands

sergeant first class *n* : a noncommissioned officer in the army ranking above a staff sergeant and below a master sergeant

sergeant fish *n* **1** : COBIA **2** : SNOOK 1

sergeant major *n, pl* **sergeants major** *or* **sergeant majors** **1** : a noncommissioned officer in the army, air force, or marine corps serving as chief administrative assistant in a headquarters **2** : a noncommissioned officer in the marine corps ranking above a first sergeant **3** : a bluish green to yellow percoid fish (*Abudefduf saxatilis*) with black vertical stripes on the sides that is widely distributed in the western tropical Atlantic ocean

sergeant major of the army : the ranking noncommissioned officer of the army serving as adviser to the chief of staff

sergeant major of the marine corps : the ranking noncommissioned officer of the marine corps serving as adviser to the commandant

ser·geanty \'sär-jənt-ē\ *n, pl* **-geant·ies** [ME *sergeantie*, fr. MF *sergentie*, fr. *sergent* sergeant] : any of numerous feudal services of a personal nature by which an estate is held of the king or other lord distinct from military tenure and from socage tenure

serg·ing \'sər-jiŋ\ *n* [*serge*] : the process of overcasting the raw edges of a fabric (as a carpet) to prevent raveling

[1]**se·ri·al** \'sir-ē-əl\ *adj* **1** : of, relating to, consisting of, or arranged in a series, rank, or row ⟨~ order⟩ **2** : appearing in successive parts or numbers ⟨a ~ story⟩ **3** : belonging to a series maturing periodically rather than on a single date ⟨~ bonds⟩ **4** : of, relating to, or being music based on a series of tones in an arbitrary but fixed pattern without regard for traditional tonality ⟨~ technique⟩ — **se·ri·al·ly** \-ə-lē\ *adv*

[2]**serial** *n* **1 a** : a work appearing (as in a magazine or on television) in parts at intervals **b** : one part of a serial work : INSTALLMENT **2** : a publication (as a newspaper or journal) issued as one of a consecutively numbered and indefinitely continued series — **se·ri·al·ist** \-ə-ləst\ *n*

se·ri·al·ism \'sir-ē-ə-,liz-əm\ *n* : serial music; *also* : the theory or practice of composing serial music

se·ri·al·iza·tion \,sir-ē-ə-lə-'zā-shən\ *n* : the act or process of serializing

se·ri·al·ize \'sir-ē-ə-,līz\ *vt* **-ized; -iz·ing** : to arrange or publish in serial form

serial number *n* : a number indicating place in a series and used as a means of identification

[1]**se·ri·ate** \'sir-ē-,āt, -ē-ət\ *adj* [(assumed) NL *seriatus*, fr. L *series*] : arranged in a series or succession — **se·ri·ate·ly** *adv*

[2]**se·ri·ate** \'sir-ē-,āt\ *vt* **-at·ed; -at·ing** : to arrange in a series

[1]**se·ri·a·tim** \,sir-ē-'āt-əm, -'at-\ *adv* [ML, fr. L *series*] : in a series

[2]**seriatim** *adj* : following seriatim

se·ri·ceous \sə-'rish-əs\ *adj* [LL *sericeus* silken, fr. L *sericum* silk garment, silk, fr. neut. of *sericus* silken, fr. Gk *sērikos*, fr. *Sēres*, an eastern Asiatic people producing silk in ancient times] : finely pubescent ⟨~ leaf⟩

ser·i·cin \'ser-ə-sən\ *n* [ISV, fr. L *sericum* silk] : a gelatinous protein that cements the two fibroin filaments in a silk fiber

seri·cul·ture \'ser-ə-,kəl-chər\ *n* [L *sericum* silk + E *culture*] : the production of raw silk by raising silkworms — **seri·cul·tur·al** \-'kəlch(-ə)-rəl\ *adj* — **seri·cul·tur·ist** \-rəst\ *n*

se·ries \'si(ə)r-(,)ēz\ *n, pl* **series** *often attrib* [L, fr. *serere* to join, link together; akin to Gk *eirein* to string together, *hormos* chain, necklace] **1** : a number of things or events of the same class coming one after another in spatial or temporal succession ⟨a concert ~⟩ ⟨the hall opened into a ~ of small rooms⟩ **2** : the indicated sum of a usu. infinite sequence of numbers **3 a** : the coins or currency of a particular country and period **b** : a group of postage stamps in different denominations **4** : a succession of volumes or issues published with related subjects or authors, similar format and price, or continuous numbering **5** : a division of rock formations that is smaller than a system and comprises rocks deposited during an epoch **6** : a group of chemical compounds related in composition and structure **7** : an arrangement of the parts of or elements in an electric circuit whereby the whole current passes through each part or element without branching **8** : a set of vowels connected by ablaut (as *i, a, u* in *ring, rang, rung*) **9 a** : a number of games (as of baseball) played usu. on consecutive days between two teams ⟨in town for a 3-game ~⟩ **b** : WORLD SERIES **10** : a group of successive coordinate sentence elements joined together ⟨an a, b, and c ~⟩ **11** : SOIL SERIES **12** : three consecutive games in bowling — **in series** : in a serial arrangement

series winding *n* : a winding in which the armature coil and the field-magnet coil are in series with the external circuit — **series-wound** \,sir-ēz-'waůnd\ *adj*

ser·if \'ser-əf\ *n* [prob. fr. D *schreef* stroke, line, fr. MD, fr. *schriven* to write, fr. L *scribere* — more at SCRIBE] : any of the short lines stemming from and at an angle to the upper and lower ends of the strokes of a letter

1 serifs

seri·graph \'ser-ə-,graf\ *n* [L *sericum* silk + Gk *graphein* to write, draw — more at CARVE] : an original color print made by pressing pigments through a silk screen with a stencil design — **se·rig·ra·pher** \sə-'rig-rə-fər\ *n* — **se·rig·ra·phy** \-fē\ *n*

se·rin \sə-'raⁿ\ *n* [F] : a small European finch (*Serinus canarius*) related to the canary

ser·ine \'se(ə)r-,ēn\ *n* [ISV *sericin* + *-ine*] : a crystalline amino acid $C_3H_7NO_3$ that occurs as a structural part of many proteins or cephalins

se·rio·com·ic \,sir-ē-ō-'käm-ik\ *adj* [*serious* + *-o-* + *comic*] : having a mixture of the serious and the comic ⟨a ~ novel⟩ — **se·rio·com·i·cal·ly** \-i-k(ə-)lē\ *adv*

se·ri·ous \'sir-ē-əs\ *adj* [ME *seryows*, fr. MF or LL; MF *serieux*, fr. LL *seriosus*, alter. of L *serius*] **1** : thoughtful or subdued in appearance or manner : SOBER **2 a** : requiring much thought or work ⟨~ study⟩ **b** : of or relating to a matter of importance ⟨a ~ play⟩ **3 a** : not joking or trifling : being in earnest **b** *archaic* : PIOUS **c** : deeply interested : DEVOTED ⟨~ fishermen⟩ **4 a** : not easily answered or solved ⟨~ objections⟩ **b** : having important or dangerous possible consequences ⟨a ~ injury⟩
syn SERIOUS, GRAVE, SOLEMN, SEDATE, STAID, SOBER, EARNEST *shared meaning element* : not light or frivolous *ant* light, flippant

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: application of:	)	Group Art Unit 3641
	)	
KIRKLAND D. BROACH et al.	)	Examiner: D.L. Greene Jr.
	)	
Serial No. 10/751,349	)	Entitled:
	)	
Filed: January 5, 2004	)	NUCLEAR FUEL ASSEMBLY
	)	DEBRIS FILTER BOTTOM
Attorney Docket No. ARF 2004-003	)	NOZZLE

August 30, 2005

Eckert Seamans Cherin & Mellott, LLC
600 Grant Street
Pittsburgh, PA 15219

MAIL STOP RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Declaration Under 37 CFR 1.132

Sir:

As a supplement to the Request for Continuing Examination and the Preliminary Amendment that are filed concurrently herewith, the following Declaration is offered:

I. Michael Y. Young declare and state:

1. That I received my Bachelor of Science degree in Mechanical Engineering from Rensselaer Polytechnic Institute at Troy, New York.

2. That I received my Master of Science degree in Mechanical Engineering from Rensselaer Polytechnic Institute .

3. That I worked for Westinghouse Electric Company LLC for 33 years.

4. That as an employee of Westinghouse Electric Company LLC, I currently hold the position of Chief Engineer.

5. That my curriculum vitae outlining the rest of my credentials is attached hereto.

6. That I have read the amended Claim 1 submitted with the amendment that is to accompany this Declaration, the Examiners rejection and the references the Examiner relied on.

7. That I am familiar with the Shallenberger design set forth in U.S. Patent No. 4,900,507, which is assigned to his employer, Westinghouse Electric Company LLC.

8. That the Shallenberger design and the teaching of the Shallenberger patent do not contemplate having a flared outlet at the fuel assembly bottom nozzle coolant flow holes nor does the Shallenberger patent describe or contemplate having a double chamfered inlet, both of which are specified in the amended Claim 1 to be filed concurrently herewith.

9. That the Shallenberger patent was published in 1990 and to the best of my knowledge, information and belief, except for the inventors of the subject application, no one has employed or suggested the use of a double chamfered inlet and flared outlet for the coolant holes in a fuel assembly bottom nozzle, since the publication of the Shallenberger patent.

10. That the double chamfered inlet and flared outlet is a novel way to achieve pressure drop reduction near that of a rounded inlet and venturi outlet while meeting numerous constraints imposed by the performance requirements of the nuclear fuel assembly, such as maintenance of uniform flow, and by the manufacturing process, such as closely spaced flow holes and accommodation of tolerances.

11. That none of the references relied upon by the Examiner suggest that a venturi profile for the coolant holes in the bottom nozzle of a fuel assembly will not adversely impact the other coolant criteria that need to be fulfilled for satisfactory coolant transport through the nuclear core.

12. That the double chamfered inlet has been found not to adversely impact the benefit of the venturi profile in the bottom nozzle coolant flow holes, but provides a significant manufacturing savings over the normal venturi gradient profile between the inlet and outlet of the venturi flow holes.

I further declare and state that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

M Young

Michael Y. Young, Declarant

August 30, 2005

Date

RESUME

Michael Y. Young
January 1, 2002

ADDRESS:

1901 Devonshire Drive Apt. 7
Columbia, SC 29204
Office: (803) 647-3673
Email: youngmy@westinghouse.com

EDUCATION:

BS - Aeronautical Engineering, Rensselaer Polytechnic Institute, Troy, New York. 1966 - 1970

MS - Mechanical Engineering, Rensselaer Polytechnic Institute, Troy, New York. 1970 - 1972

EXPERIENCE:

2001- 2005: Chief Engineer, Nuclear Fuels

Currently responsible for:

1. Identification of Technological Opportunities for Nuclear Fuels: Lead the process to identify areas where technological opportunities exist, which could produce significant breakthroughs. Utilize this knowledge to focus the organization's technology, research, and development activities.
2. Technical Knowledge Management: As appropriate, ensure that there is continuous organizational leveraging and integration of historical technological solutions and new research & development activities, including:
    a. Coordination of Development Programs
    b. Industry interactions to assure consistent positions and approach
    c. Foster key University relationships
    d. Review and solicit key technical papers and establish strategy for attending conferences
3. Ensure an organizational understanding of the unmet needs of the nuclear fuel customer (operational, licensing, margins, etc.. Develop actions/plans to address these needs.
4. Facilitate the allocation of funding for development projects, oversee completion of those activities, and monitor progress.
5. Technological Problem Resolution – Where appropriate, lead and/or facilitate technological review teams to review critical technical issues, new designs and services, etc. Serve as the technical final solution in areas of technical disputes and coordinate resolution of these issues. Lead department task teams addressing critical high impact

issues involving multi-discipline functions.

6. Key Strategic Initiatives – Where appropriate & assigned, lead the implementation of key strategic initiatives which develop high value for customers and NFBU. Interface with the Strategy Department to provide key technical strategy input.

1993-2001: Consulting Engineer, Nuclear Services and Nuclear Fuels.

Led team developing Next Generation Fuel grid.

Led team to resolve the V5H grid to rod fretting issue. Outcome was development of the RFA-2 grid design and a more complete understanding of fretting phenomena that should prevent problems in future.

Led multi-division team to resolve the Axial Offset Anomaly issue. Role included defining test and development programs, interactions with customers and EPRI, and development of predictive tool to determine AOA risk of core designs. Outcome was the BOB code, increased understanding of crud deposition and AOA process, and an influential position in the EPRI/Utility AOA working group.

Led team developing the safety case for the AP600 advanced reactor design. Prepared strategy for making presentations to the Advisory Committee on Reactor Safeguards, a key obstacle to approval of the AP600 design.

Led team of experts in 4 year project to develop new computer technology for nuclear safety analysis ("Best Estimate" Loss of Coolant Accident Evaluation Model). Project involved solution of numerous problems in thermal-hydraulics, numerical methods, and probability, and continual interaction and negotiation with Nuclear Regulatory Commission (NRC) and Advisory Committee on Reactor Safeguards (ACRS). Successful licensing of methodology (the first of its kind in the industry) required high degree of credibility in discussions with NRC and ACRS.

1991-1993: Manager, Nuclear Safety Analysis, Westinghouse Energy Systems Business Unit.

Managed technical staff of 6 managers and approximately 100 engineers engaged in safety and engineering analysis. Group was responsible for sales of approximately ten to fifteen million dollars per year. Responsibilities included interactions with customers and NRC to resolve licensing and technical issues, including application of new reporting regulations for computer code changes, and application of 10CFR50.59 safety evaluation process.

1981-1991: Manager, Thermal Hydraulic Testing and Analysis, Westinghouse Energy Systems Business Unit.

Initiated program to develop an advanced Loss of Coolant Accident (LOCA) analysis technology, using statistical methodology.

Managed group of 15 engineers responsible for designing and overseeing the performance of several test and analysis programs, including the FLECHT reflood heat transfer and MB-2 steam generator programs.

Worked with Westinghouse Owner's Group (WOG) to resolve several key issues such as quantifying the extent of radiation release in steam generator tube rupture.

Helped resolve the clad ballooning issue that was a key obstacle in licensing PWRs in the UK.

Successfully obtained approval by NRC for application of improved safety analysis methods (BASH code). These methods allowed Westinghouse to supply new nuclear fuel designs with higher peaking factors than the competition.

1972-1981: Engineer, Westinghouse Nuclear Energy Systems.

Began Westinghouse career as associate engineer in 1972. Helped develop Westinghouse Appendix K LOCA model. Was lead engineer in effort to license Upper Head Injection system for Sequoyah Nuclear Plant. Developed first significant improvement to the Appendix K model for increased LOCA margin (the BART code). Work required frequent presentations and negotiations with NRC staff and other oversight committees.

OUTSIDE ACTIVITIES:

1987, 1988 Commissioner, Little League Baseball
1986, 1987, 1988 Coach, Little League Baseball
1985-1989, Member and president of neighborhood pool committee

AWARDS:

Division Engineering awards in 1980, 1984, 1987, 1989, 1995, 2000
George Westinghouse company award, 2001.

PAPERS:

1. "A Mechanistic Model for the Best Estimate Analysis of Reflood Transients (The BART Code)", 19th National Heat transfer Conference, Orlando, Florida, 1980.
2. "Advances in PWR LOCA Analysis", Technical Workshop on Nuclear Reactor Safety and Thermo-hydraulics, Seoul, Korea, 1985.
3. "An Implicit Method to Speed up WCOBRA/TRAC", Nuclear Science and Engineering, 1988.
4. "Application of Realistic Thermal-Hydraulic Methods for Pressurized Water Reactors with Upper Plenum Injection", Nuclear Technology, 1989.
5. "Development of LOCA Margin for Two-Loop PWR", Nuclear Plant Journal, January, 1989.

6. “Downflow Two-Phase Pressure Drop in Irregular Channels with Plates”, Int. Symposium on Gas-liquid Two Phase Flows, ASME Winter Annual Meeting, 1990.
7. “Application of PWR LOCA Margin with the Revised Appendix K Rule”, Nuclear Engineering and Design, 1992.
8. "Application of code scaling and uncertainty methodology to the large break loss of coolant", Nuclear Engineering and Design, 1998
9. "Assessment of flooding in a best estimate thermal hydraulic code (WCOBRA/TRAC)", Nuclear Engineering and Design, 1998.
10. "Best Estimate Analysis of the large break loss of coolant accident", ICONE-6, 1998
11. "Flooding in the pressurizer surge line of AP600 plant and analyses of APEX data", Nuclear Engineering and Design, 1999.
12. "Direct contact heat transfer model for dispersed flow film boiling", Nuclear Technology, December 2000.
13. "The flow field in a reactor core and its effect on rod vibration and wear", ASME Pressure Vessels and Piping Conference, July 2001.
14. "Flow Induced Vibration and Fretting Wear in PWR Fuel", ICONE 10, April 2002.
15. “The Effect Of Corrosion Product Deposition On Fuel Management”, Advances in Nuclear Fuel Management III (ANFM 2003), October 5-8, 2003.
16. “A Comprehensive Method for Assessing Fuel Performance Risks Due to Crud Deposition”, Proceedings of the 2004 International Meeting on LWR Fuel Performance, Orlando, Florida, September 19-22, 2004.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: application of:	)	Group Art Unit 3641
KIRKLAND D. BROACH et al.	)	Examiner: D.L. Greene Jr.
Serial No. 10/751,349	)	Entitled:
Filed: January 5, 2004	)	NUCLEAR FUEL ASSEMBLY DEBRIS FILTER BOTTOM NOZZLE
Attorney Docket No. ARF 2004-003	)	

April 6, 2006

Eckert Seamans Cherin & Mellott, LLC
600 Grant Street
Pittsburgh, PA 15219

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Supplemental Declaration Under 37 CFR 1.132

Sir:

As a supplement to the Declaration Under 37 CFR 1.132 of Michael Y. Young dated August 30, 2005, in furtherance of allowance of the above captioned matter, the following Declaration is offered:

I, Michael Y. Young, declare and state:

1. That I have reviewed and understand the contents of the specification of the above captioned application, including the claims as amended by the response to the Office action dated November 16, 2005, which accompanies and references this Supplemental Declaration Under 37 CFR 1.132.

2. That fluid dynamics within the core of a nuclear reactor are complicated by the large number of structures in the path of the coolant, the need to continually maintain contact of the coolant with the fuel cladding to avoid reduced heat transfer and the objective of maximizing heat transfer between the fuel elements and the coolant.

3. That Westinghouse has observed an appreciable difference (20%) in hydraulic pressure drop between nozzles fabricated by two different vendors to design specifications based on the Shallenberger patent. Furthermore, Westinghouse's investigation into the differences concluded that the main cause for these differences were minute geometry differences introduced by removing burrs caused by the chamfer machining operations. The inability to specify, measure, and control these minute geometries caused by burr removal, provided impetus to improve upon Shallenberger.

4. That neither Westinghouse, with approximately 30 years experience producing fuel assembly nozzles, nor its outside fabricators found it obvious that the small geometry changes caused by burr removal could result in 20% variation in hydraulic performance.

5. That through experimentation Westinghouse found that the double chamfered inlet and flared outlet is a way to achieve pressure drop reduction near that of a rounded inlet and venturi outlet while meeting numerous constraints imposed by the performance requirements of the nuclear fuel assembly, such as consistent and uniform flow between assemblies, reasonable manufacturing costs, closely spaced flow holes, and fabrication tolerances.

6. That none of the references relied upon by the Examiner suggest that a venturi profile for the coolant holes formed with a double chamfered inlet in the bottom nozzle of a fuel assembly will not adversely impact the other coolant criteria that need to be fulfilled for satisfactory coolant transport through the nuclear core and still provide the hydraulic margin necessary to accommodate surface anomalies that arise in the manufacturing process.

7. That Westinghouse test results have shown that the double chamfered inlet has been found not to adversely impact the benefit of the venturi profile in the bottom nozzle coolant flow holes, but provides a significant manufacturing savings over the normal venturi gradient profile between the inlet and outlet of the venturi flow holes.

I further declare and state that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

M Young

Michael Y. Young, Declarant

5/4/2006

Date

RELATED PROCEEDINGS APPENDIX

None.